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This Issue of the Journal

Risk factors and characteristics of patients with gonorrhoea presenting to Auckland Sexual Health Service, New Zealand
S Azariah, N Perkins

Institute for Environmental Science & Research (ESR) data demonstrate that gonorrhoea rates in the Auckland region have been steadily rising over the last 5 years. An audit of cases presenting to Auckland Sexual Heath Service over 6 months found that the most common risk factors for acquiring gonorrhoea were age under 25 and being of Maori or Pacific ethnicity. Reasons for ethnic differences in gonorrhoea rates in New Zealand are not well understood—more research is needed. Consistent condom use was found to lower the risk of acquiring gonorrhoea, so condoms should continue to be a major component of any health promotion strategy aimed at reducing incidence of sexually transmitted infections (STIs). Antibiotic resistance in gonorrhoea isolates has also been steadily increasing in Auckland, in common with other countries in the Western Pacific region—this is concerning, as alternatives to current treatments may be difficult to find.

Chlamydia screening in Wellington Family Planning Association (FPA) clinics: a demonstration project
M Sparrow, H Lewis, P Brown, C Bromhead, D Fernando, A Maitra

Chlamydia, a common STI, is recognised as a major problem in young persons in New Zealand. A relatively simple urine test is available to screen for the disease and this is fortunate because the disease can be present and cause harm without there being any symptoms, especially in women where chlamydia is a major cause of infertility. Unless they are tested, sexually active young persons may be carrying the disease and unknowingly passing it on to partners. Although staff at FPA are trained to screen for this infection, many potentially infected clients remain unscreened. In this study we wished to demonstrate that improvements could be made to screening practices that were feasible and practical for busy staff and acceptable to clients. Over 6 months (at FPA clinics in Wellington, Lower Hutt, and Porirua) we offered screening to all young persons, and carried out 2533 screening tests. We found 8% were positive for chlamydia, and infection was more likely in those with a history of partner change and in Māori and Pacific ethnic groups. Those least likely to be infected were those who always used condoms. These results largely confirm what has been found in other studies. Our main interest was in improving screening procedures and influencing staff attitudes to screening. Successful screening relied very much on the participation of trained receptionists and nurses. For all staff, time was the greatest barrier to screening. For clients, the requirement not to have passed urine within the last hour was the main reason for not screening. Clients found the procedures very acceptable.
Health outcomes for diabetes patients returning for three annual general practice checks
A Tomlin, S Dovey, M Tilyard

Diabetes patients in New Zealand may receive free annual general practice examinations for their diabetes as part of the Get Checked program. This study examined changes (between the first examination and the third examination 2 years later) in the health status of South Island patients with Type 1 or Type 2 diabetes. There were significant improvements in the control of blood pressure and cholesterol levels and in the number of patients receiving eye and foot examinations. There was, however, no overall improvement in the control of blood sugar levels. The quality of care provided to diabetes patients enrolled in this program is improving.

Treatment of anaphylaxis in adults: results of a survey of doctors at Dunedin Hospital, New Zealand
S Thain, J Rubython

This survey looked at how doctors proposed to treat a patient with a severe allergic reaction (anaphylaxis). Most doctors knew the appropriate drug to give (adrenaline), but only 20% knew how much to give and how to give it. 20% of doctors questioned proposed giving a potentially harmful dose of the drug. Given that anaphylaxis is a potentially life-threatening condition, all doctors should know how to treat it.
Prevention and control of sexually transmitted infections in New Zealand

Jillian Sherwood, Edward Coughlan

Sexually transmitted infections (STIs) are a major cause of acute illness, long-term disability, infertility, cervical cancer, and death worldwide. Prevention and control of STIs is a complex challenge, but the resulting human and economic costs are almost completely preventable, especially for bacterial STIs.

There are significant gaps in the information available on the epidemiology of STIs in New Zealand as the national surveillance system is based primarily on reporting from clinics (sexual health, family planning and student and youth). Laboratory data on gonorrhoea and chlamydia testing are also collected for surveillance purposes but are complete in only three District Health Board (DHB) regions of the country.

These data suggest there may be a high incidence of gonorrhoea and chlamydia in the general population relative to other industrialised countries. The regional laboratory data have shown a significant increase in rates from 2001 to 2005. More sensitive testing methods and higher test volumes may partly explain increased chlamydia rates, but there appears to be a true increase in gonorrhoea rates. Certainly these rates represent a considerable burden of disease in New Zealand and warrant review of current efforts to control and improve this situation.

A range of strategies are required for STI prevention and control programmes, including primary prevention strategies and strategies that reduce individual morbidity and transmission within the population. The ultimate goal is to reduce population prevalence.

As for other communicable diseases, the likelihood of controlling prevalence may be considered using the basic reproductive number equation \( R_0 = BcD \). This reminds us that the number of new infections generated by an infected person (\( R_0 \)) is a function of the average probability of transmission from an infected to uninfected person (\( B \)), the average rate of partner change (\( c \)) and the average duration of infectivity of an infected person (\( D \)). Hence opportunities for control of STIs exist by reducing any of these parameters as that will lower the reproductive number.

Health promotion and social marketing programmes that promote safer sexual health practices are aimed at reducing the likelihood of transmission by use of condoms or non-penetrative sexual practices. Such programmes may also aim to reduce the average rate of partner change by decreasing the number of partners, encouraging monogamy, and delaying the onset of first coitus.

Early identification and effective treatment of cases will reduce the period of infectivity for curable STIs and may be achieved through improved case finding (by screening, identification of social networks or clusters) and contact tracing. Provision of user-friendly services, and identification of specific “core” groups with higher-risk behaviours and subsequent targeting of appropriate programmes and services to them, may also reduce the interval to treatment.
There are a range of strategies and research being employed in New Zealand in an attempt to stem this rising rate of STIs, but these lack central co-ordination. The No Rubba, No Hubba Hubba social marketing campaign run by the Ministry of Health in 2004–2005 was not an ongoing campaign. Evaluation showed it raised awareness in the target group but it is not known whether this resulted in behaviour change.

New Zealand has seen growing interest for a chlamydia screening programme. Results of the Family Planning Association screening study undertaken during 2004–2005 at its Wellington and Hutt Valley Clinics are reported in this issue of the NZMJ by Sparrow and colleagues (Chlamydia screening in Wellington Family Planning Association (FPA) clinics: a demonstration project; [http://www.nzma.org.nz/journal/120-1252/2490](http://www.nzma.org.nz/journal/120-1252/2490))

Although the study population and setting differed, in some aspects, from the wider population, the study had some important findings for future screening undertaken in other primary care settings in this country. The test positivity rate of 8% in this population of mainly asymptomatic, young European females is of concern as it is considerably higher than has been found in other recent studies in New Zealand. The study has clearly demonstrated that screening by opportunistic invitation is acceptable to staff and clientele in this setting and is feasible.

The relatively high success rate for contact tracing and treatment by using client/patient referral is a similar finding to that recently reported by the team evaluating the chlamydia screening programme in England. However it is also of interest that testing rates dropped off after the study was completed thus suggesting that an otherwise unsupported recommendation to screen may be insufficient to ensure that screening is carried out by healthcare professionals.

Another article on STIs published in this issue of the NZMJ (Azariah and Perkins; Risk factors and characteristics of patients with gonorrhoea presenting to Auckland Sexual Health Service, New Zealand; [http://www.nzma.org.nz/journal/120-1252/2491](http://www.nzma.org.nz/journal/120-1252/2491)) presents the results of an audit undertaken by the Auckland Sexual Health Service (ASHS) to determine risk factors for acquisition of gonorrhoea and patterns of transmission of ciprofloxacin-resistant gonorrhoea in 2003/2004.

It is well accepted that STI transmission is directly influenced by behavioural factors, which can lead to uneven patterns of transmission across the population creating a concentration of cases in specific populations. This is especially true for syphilis and gonorrhoea in industrialised countries. Therefore, given the recent significant increase in gonorrhoea rates in Auckland region, collection of risk factor information is of importance to inform planning and targeting of interventions.

Apart from age, the other risk factors identified in this audit (Māori or Pacific ethnicity, local acquisition of infection) cannot be extrapolated to the general population, however, as the data are from clinic cases only and laboratory data for 2003 and 2004 show that the majority of gonorrhoeal infections diagnosed in Auckland were outside of ASHS (65.6% and 64.5% respectively). This underscores the need for ethnicity data to be collected as part of laboratory demographics and the value of having a surveillance system with the potential to undertake enhanced surveillance on cases diagnosed outside of sexual health clinics.
Concern over the burden of disease from STIs was identified as a priority by the Government in the *Sexual and Reproductive Health Strategy Phase One* document released in 2001. Follow up with development of an STI Action Plan was planned but this was replaced by a resource book for healthcare organisations *Sexual and Reproductive Health*. This effectively shifted the focus from central leadership (and resourcing) to the DHBs and primary care providers.

While this change supported development of locally appropriate initiatives, it appears to have stalled or slowed down progress on needed changes to the STI surveillance system, development of national guidelines for STI management and contact tracing, standardisation of laboratory tests and protocols, and ongoing funding of a national social marketing campaign for STI prevention—all things that require central planning and a national perspective.

There are encouraging signs that sexual health has regained some standing among Ministry of Health priorities. To assist with policy and service development, the Public Health Directorate convened an advisory group meeting in 2006 to revisit the question of modification of the STI surveillance system, and surveyed DHBs on sexual and reproductive health services and issues.


A recent report on chlamydia screening prepared for the National Screening Unit recommends: improving the STI surveillance system; making adherence to screening recommendations a performance indicator for PHOs in DHB contracts; developing national guidelines for STI management; and establishing a national advisory group.

While it is heartening to hear that subsequent to this a Sexual Health Advisory Group has been established, it remains unclear whether the necessary funding and resources will be allocated to support the recommendations of this group and the work already being done by DHBs and primary care providers.

**Competing interest:** None.

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**References:**


The integration of managed healthcare in New Zealand

James Reid

The scope of New Zealand’s integrated healthcare, and knowledge about general practitioners’ scope of practice, is generally unknown. Knowledge about the integration between primary care nursing and general practitioners (and of the developing incorporation of what was contained within the realm of secondary care into primary care) is similarly lacking.

In this issue of the *Journal*, Rea et al describe a model of chronic care management of Counties Manukau District Health Board patients with diabetes, congestive heart failure, chronic obstructive pulmonary disease (COPD), cardiovascular disease, and depression (*Chronic Care Management evolves towards Integrated Care in Counties Manukau, New Zealand*; [http://www.nzma.org.nz/journal/120-1252/2489](http://www.nzma.org.nz/journal/120-1252/2489)). Undoubtedly, these patients provide a heavy load for the overall health system, and an even greater load when they are admitted to hospital.¹

With the implementation and continuing evolution of the *Primary Health Care Strategy*,² there will be increasing blurring of the margins of primary and secondary care in New Zealand. The *Strategy* aims to reduce health disparities; it also recognises the need to reduce the impact of chronic illness, with specific emphasis on healthcare delivery in primary care.

Integrated care is a term that “describes a goal of ‘seamless’ care for patients with acute and chronic problems at any point in the health system”. What is vitally important, however, is that one’s right hand needs to know what the left is doing! This will avoid duplication of services, and waste.

In response to the increasing burden of escalating admissions to Middlemore Hospital due to exacerbations of chronic illness, a system of chronic care management (CCM) was introduced in Counties Manukau in 2001. As it reduced the hospital’s admission growth rate from 9% to zero,³ it was deemed to be successful.

Funding was supplied to train staff and to support dedicated time for proactive management of the chronic conditions, and it was the core to the CCM programme’s success. Time is of the essence for GPs who struggle with ever-increasing bureaucratic requirements, compliance issues, and data management. Most of the funded time in this programme was spent by practice nurses aided by decision-support computer software.

There is now some funding in place throughout the country for primary care in the form of capitation funding as well as *Care Plus*—a programme introduced in 2004 that provides 2 hours of paid time every 6 months for either the GP or (most importantly) the practice nurse to spend individually with chronically ill patients to promote illness management.
Uptake of the programme has been sporadic, with some areas in the country being much more successful in recruitment than others. For patients, it is often a confusing system—they are occasionally asked to pay full fees when consulting whereas other times the service is provided at no charge, or at a minimal fee. This is in contrast to a “high-user” patient who must attend their GP 12 or more times per year. However these health promotional activities will not achieve their goals unless developments in primary care are acknowledged in secondary care, and services in the latter tailored accordingly. For example, in Dunedin, South Link (the local Independent Practitioners Association [IPA]) has been organising a successful coronary risk management programme, *Cardiovascular Risk Annual Evaluation*, in which all patients with known coronary artery disease were formally reviewed annually by the practice nurse and then their risk assessed. An identical and parallel programme for patients admitted to hospital is run (again nurse-oriented) by the Otago District Health Board. The number of similar programmes throughout the country must be numerous.

It can be argued that general practice is an undervalued and underutilised resource in chronic care management. While general practice is relatively cheap compared to secondary-based care, it is frequently seen by patients, and health administrators (in secondary-based care) are expensive.

Many medications are unavailable to GPs without specialist referral, and this is a process which can take months in many areas. Many investigations are also unavailable to GPs in the public system; for example, echocardiograms—regarded as an essential investigation in cardiac care guidelines—remain unavailable without referral. Similarly, MRIs and CTs remain beyond GPs’ reach. In many places, audiology and provision of orthotic supports are outside the scope of provision of GPs, and many now-common drugs (e.g. dipyridamole) are unavailable without referral.

As a result, there is delay in provision of optimal treatment, and clinics are clogged with referrals which could very adequately and appropriately be cared for by a quality general practice team.

Public Health Organisations (PHOs) are required to initiate a performance management programme in their areas of influence. This will provide payment for agreed performance indicators. While some would argue that those currently listed are inappropriate, they are a step in encouraging “best practice”.

The Counties Manukau programme is a model which could form the basis on a nationwide programme, but first an agreed framework (with buy-in from all parties whereby data can be appropriately handled and enacted) is needed. Goodwill and acknowledgement of the roles of both primary and secondary care are also important.

**Competing interests:** None.

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References:


Risk factors and characteristics of patients with gonorrhoea presenting to Auckland Sexual Health Service, New Zealand

Sunita Azariah, Nicky Perkins

Abstract

Aims A case-control study of patients with gonorrhoea presenting to Auckland Sexual Health Service was carried out to determine specific risk factors and to look more closely at the transmission of ciprofloxacin-resistant Neisseria gonorrhoeae in the Auckland region.

Methods Patients who tested positive for gonorrhoea during a 6-month time period from September 2003 till March 2004 were included in the study. A control group was selected from patients who presented during the same time period but who had negative sexually transmitted infection (STI) screens. A selection of N. gonorrhoeae isolates were sent to ESR for typing by pulsed-field gel electrophoresis (PFGE).

Results 204 cases of gonorrhoea were identified during the study period; 50% of the diagnosed cases were in people aged less than 26 years. Gonococcal infection was strongly associated with being of either Māori or Pacific ethnicity (p<0.001). A history of consistent condom use was found to lower the risk of acquisition of gonorrhoea (p=0.009). Thirty-three percent of cases had ciprofloxacin-resistant gonococcal infection and the majority of these acquired their infection in New Zealand (88%). Comparison of PFGE genotyping data with results from an audit in 2001 indicated that genetic diversity amongst ciprofloxacin-resistant isolates has increased significantly.

Conclusion The incidence of gonorrhoea in the Auckland population is steadily rising, with the main risk factors being age under 25 and being of Māori or Pacific ethnicity. Genetic diversity amongst ciprofloxacin-resistant isolates is increasing, thus indicating high levels of endemic infection. Urgent action needs to be taken to control the current gonorrhoea epidemic in Auckland and more research is required to investigate reasons for ethnic differences in disease incidence.

Gonorrhoea is a bacterial sexually transmitted infection (STI) that has become more common in recent years in New Zealand. Laboratory surveillance in Auckland, Waikato, and the Bay of Plenty (BOP) regions during the last 5 years has shown a steady annual rise in the number of infections diagnosed each year (Figure 1). Population-based incident rates for gonorrhoea in the Auckland region during the January to March 2006 quarter were 1091 per 100,000 for people aged 20–24 years. Fifty-three percent of infections in Auckland occurred in people aged 15–24 years.
New Zealand’s relatively high rates of gonorrhoea are worrying as the potential impact on reproductive health is quite significant, given that 10–20% of women with cervical gonorrhoea infection may develop pelvic inflammatory disease (PID), and 10–30% of men with urethral infection may develop epididymitis.

Neonatal morbidity is also affected—as vertical transmission occurs in approximately 40% of infants born to infected women, resulting in either neonatal conjunctivitis or disseminated infection. Although gonorrhoea is easy to treat with a single dose of an appropriate antibiotic, antibiotic resistance is continuously evolving—19% of isolates at Auckland Sexual Health Service now being resistant to ciprofloxacin.

The following audit was carried out to determine more precisely the risk factors for acquisition of gonorrhoea and to look at patterns of transmission of ciprofloxacin-resistant gonorrhoea. It is envisaged that this data will be helpful in the development of targeted screening programmes in the Auckland region to control the current epidemic.

**Methods**

The study consisted of a case-control study of patients diagnosed with gonorrhoea at Auckland Sexual Health Service (ASHS). Auckland Sexual Health Service is a regional service which has a large catchment area covering three district health boards (Auckland, Waitemata, and Counties-Manukau). There are four regional clinics located in Mangere, Henderson, Glenfield, and Greenlane Clinical Centre (formerly Greenlane/National Women’s Hospital). There are also two outreach clinics—one in Wellsford and one in inner-city Auckland at the New Zealand Prostitutes’ Collective.

ASHS routinely collects clinical data on patients seen at all regional and outreach clinics. The clinician seeing a particular patient assigns them with a diagnostic code on each presentation to the clinic with a
new problem. Anonymous data on newly diagnosed cases of STIs are sent on a quarterly basis from all public sexual health clinics to ESR for surveillance purposes.

A search was conducted of the ASHS database for all patients who were coded with a diagnosis of gonorrhoea during the time period 1 September 2003 till 31 March 2004. The inclusion criterion for the study was any patient who had a positive test for gonorrhoea from any anatomical site during the study period.

The majority of cases were diagnosed by culture but a small number were diagnosed by strand displacement amplification (SDA), a nucleic acid amplification test (NAAT). Controls were identified by searching the same database during the same time period. Inclusion criteria for controls were patients who presented for an STI check, who were not contacts of chlamydia or gonorrhoea and whose STI screens were reported as negative for chlamydia, gonorrhoea, and trichomoniasis.

No matching of controls was done except for the time of presentation to ASHS. Control cases were selected randomly from the relevant time period until there was adequate representation from each of the 4 main clinics according to their respective workload. 104 controls were selected via this method. The notes for all identified cases and controls were then scrutinised to check whether they fitted the inclusion criteria for the audit before analysis of demographic data and clinical data was carried out.

Logistic regression was used to investigate factors related to the diagnosis of gonorrhoea. The outcome used was gonorrhoea case or control, and the explanatory variables were gender, age, ethnicity, number of partners, condom use, sexual orientation, and clinic attended.

A separate analysis was run including male subjects only, and this included an investigation of the interaction between men who have sex with men (MSM) and age. There were not enough non-European groups to include investigation of the interaction between MSM and ethnicity.

Results

Results have been reported for those patients who had the relevant data recorded in their notes, so if data was missing from the file it was not included in the results. Results have been tagged for the number of patients for whom information was available in each category.

Demographic data

Location—The majority of cases were diagnosed at the central and south clinics (84%). Of the 204 cases of gonorrhoea identified during the study period, 62% were male and 38% were female (Table 1). There was a wide age range among cases, with the youngest aged 14 years and the oldest aged 58 years. Fifty percent of cases occurred in those aged 25 or under with a mean age of 27.5. These results are similar to laboratory surveillance data where 53% of cases are diagnosed in the under-25 age group. The control group similarly had a wide age range (16 to 58) but an older mean age of 30. There was no significant difference found between ages of cases and controls (p=0.93).

Ethnicities of cases—Ethnicity data was recorded for all 204 cases. Forty-two percent were European, 28% (57) were New Zealand Māori, 21% (44) were Pacific, and 9% (18) were of other ethnicities (Figure 2).

In contrast, the vast majority of controls identified as European (74%) with only a small proportion identifying as Māori (4%) or Pacific (5%). Those of Māori or Pacific ethnicity were at higher risk of being diagnosed with gonorrhoea than other ethnicities (p<0.001, Table 1).
Table 1. Demographic characteristics of the gonorrhoea cases

<table>
<thead>
<tr>
<th>Variable</th>
<th>Cases (n=204)</th>
<th>Controls (n=104)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Clinic</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>South</td>
<td>85 (42%)</td>
<td>31 (30%)</td>
<td></td>
</tr>
<tr>
<td>Central</td>
<td>85 (42%)</td>
<td>43 (41%)</td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>24 (12%)</td>
<td>22 (21%)</td>
<td></td>
</tr>
<tr>
<td>North</td>
<td>8 (4%)</td>
<td>8 (8%)</td>
<td></td>
</tr>
<tr>
<td>Outreach</td>
<td>2 (1%)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>204</td>
<td>104</td>
<td></td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td>p=0.93</td>
</tr>
<tr>
<td>&lt;15</td>
<td>n=204</td>
<td>n=104</td>
<td></td>
</tr>
<tr>
<td>16-20</td>
<td>7 (3%)</td>
<td>15 (14%)</td>
<td></td>
</tr>
<tr>
<td>21-25</td>
<td>43 (21%)</td>
<td>22 (21%)</td>
<td></td>
</tr>
<tr>
<td>26-30</td>
<td>53 (26%)</td>
<td>28 (27%)</td>
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</tr>
<tr>
<td>31-35</td>
<td>36 (18%)</td>
<td>19 (18%)</td>
<td></td>
</tr>
<tr>
<td>36-40</td>
<td>20 (10%)</td>
<td>11 (11%)</td>
<td></td>
</tr>
<tr>
<td>&gt;40</td>
<td>26 (13%)</td>
<td>9 (9%)</td>
<td></td>
</tr>
<tr>
<td><strong>Mean age</strong></td>
<td>27.5</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>New Zealand Māori</td>
<td>n=204</td>
<td>n=104</td>
<td></td>
</tr>
<tr>
<td>European/Pakeha</td>
<td>56 (27%)</td>
<td>77 (74%)</td>
<td></td>
</tr>
<tr>
<td>Pacific*</td>
<td>86 (42%)</td>
<td>4 (4%)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>44 (22%)</td>
<td>5 (5%)</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>204</td>
<td>104</td>
<td></td>
</tr>
<tr>
<td><strong>Sexual orientation</strong></td>
<td></td>
<td></td>
<td>p=0.18</td>
</tr>
<tr>
<td>Heterosexual males</td>
<td>(n=201)</td>
<td>(n=103)</td>
<td></td>
</tr>
<tr>
<td>Heterosexual females</td>
<td>87 (43%)</td>
<td>45 (44%)</td>
<td></td>
</tr>
<tr>
<td>MSM</td>
<td>76 (37%)</td>
<td>38 (37%)</td>
<td></td>
</tr>
<tr>
<td>Bisexual females</td>
<td>36 (18%)</td>
<td>18 (18%)</td>
<td></td>
</tr>
<tr>
<td>Not Stated</td>
<td>2 (1%)</td>
<td>2 (2%)</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>204</td>
<td>104</td>
<td></td>
</tr>
<tr>
<td><strong>Number of partners</strong>†</td>
<td>(n= 197)</td>
<td>(n=103)</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>11 (11%)</td>
<td>p=0.05</td>
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<tr>
<td>1</td>
<td>83 (42%)</td>
<td>47 (45%)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>55 (28%)</td>
<td>22 (21%)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>20 (10%)</td>
<td>11 (11%)</td>
<td></td>
</tr>
<tr>
<td>&gt;3</td>
<td>39 (20%)</td>
<td>12 (12%)</td>
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</tr>
<tr>
<td>Not documented</td>
<td>7</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>Condom use</strong>‡</td>
<td>(n=187)</td>
<td>(n=89)</td>
<td>p=0.009</td>
</tr>
<tr>
<td>Never</td>
<td>117 (63%)</td>
<td>38 (43%)</td>
<td></td>
</tr>
<tr>
<td>Sometimes</td>
<td>53 (28%)</td>
<td>31 (35%)</td>
<td></td>
</tr>
<tr>
<td>Always</td>
<td>17 (9%)</td>
<td>20 (22%)</td>
<td></td>
</tr>
<tr>
<td>Not documented</td>
<td>17</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Not applicable (no sex)</td>
<td>10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MSM=Men who have sex with men; *Mostly of Samoan, Tongan, Niuean, or Cook Islands origin. †Self-reported within last 3 months; ‡Self-reported within last 3 months.
Regional variation—As expected there was regional variation in the demographic data for patients. For example, the south clinic had far greater proportions of Māori (35%) and Pacific people (38%) diagnosed with gonorrhoea compared with the central clinic (16% and 11% respectively), mainly because the south clinic is situated in an area where more Māori and Pacific people reside.

Sexual behaviour—The gender of sexual partners was recorded for 201 cases. Eighty-one percent of cases (164) were exclusively heterosexual—i.e. they reported only sexual partners of the opposite sex. Thirty-four men (17%) reported only male sexual partners and 2 men reported both male and female sexual partners (1%) (Figure 4).

For the purposes of this audit homosexual and bisexual men have been grouped together under the term men who have sex with men (MSM). The central clinic saw the vast majority of cases diagnosed in MSM, (78%) reflecting the fact that in Auckland, similar to other developed countries, gay men tend to reside in inner urban locations (at the time the audit was undertaken the central clinic was located at Auckland City Hospital—much closer to the CBD then the Greenlane Clinical Centre). No female cases reported sex exclusively with other women.
The majority of the control group was also heterosexual (89%) with a much smaller proportion of the sample identifying as MSM (9%), however sexual orientation was not found to be a risk factor for acquiring gonorrhoea (p= 0.18, Table 1).

**Figure 4. Sexual orientation of gonorrhoea cases (n=201)**

![Sexual Orientation Pie Chart]

**Number of sexual partners**—This is based on self-reported information from the case notes so is subject to reporting bias. Clients are routinely asked about the number of sexual contacts they have had in the preceding 3 months as this is useful information with respect to contact tracing.

Cases of gonorrhoea reported more sexual contacts in the preceding 3 months to diagnosis than did controls, with 20% reporting 3 or more sexual partners in the 3 months preceding diagnosis compared with 12% of controls. (p=0.05). Gender and sexual orientation within the case group appeared to affect reported numbers of sexual partners. Male cases reported higher numbers of sexual partners than female cases, and MSM reported more sexual partners than heterosexual males, however these differences were not found to be statistically significant. The small numbers of MSM in this sample made it difficult to make any meaningful biostatistical correlations for risk factors.

**Figure 5. Numbers of sexual contacts (p=0.05) within previous 3 months: gonorrhoea cases and controls compared (n=197)**

![Sexual Contacts Bar Chart]

**Condom use**—Again this data was based on self-reported information from the case notes, so there will be reporting bias as well as limitations as to how meticulously the sexual history was taken. Clients who reported no unprotected intercourse in the 3
months preceding diagnosis were classified as “consistent” condom users. Those who reported no use of condoms in the 3 months preceding diagnosis were classified as “never” having used condoms. Those who were recorded as not using condoms for every recorded sexual encounter in the preceding 3 months were classified as “sometimes”.

The control group (22%) were far more likely to report consistent condom use than the cases (8%) and were less likely to have reported never using condoms in the preceding 3 months (43% and 58% respectively) (p=0.009, Table 1). This finding supports the continued promotion of condom use in prevention of bacterial sexually transmitted infections, however the retrospective nature of the study lends bias to this finding.

Figure 6. Reported condom use in previous 3 months: gonorrhoea cases and controls compared (n=187)

Interestingly MSM cases reported similar levels of consistent condom use (24%) to controls (22%). The risk of gonorrhoea acquisition in MSM despite reported similar levels of consistent condom use is probably partly related to transmission by oral sex—an activity that is perceived as “safe” by many MSM.

Clinical data

Site of infection—This data should be regarded as incomplete as not all patients are screened from all urogenital sites. Gonorrhoea cultures are routinely taken from the urethra and cervix of all women presenting for sexual health screening at ASHS. Depending on the sexual history and the clinician, samples may also be taken from the pharynx and rectum. Heterosexual males are very rarely cultured from any other site apart from the urethra while MSM may be sampled from the urethra, pharynx or rectum, depending on the sexual history.

Eighty-eight percent of women were diagnosed from the cervical and urethral cultures, but a small number of cases would have been missed if other sites had not been sampled.

The most common site of infection in MSM (n=36) was the urethra (31%), but 28% were positive only from the rectum and 19% were only positive at the pharyngeal site. Although the numbers are small, this emphasises the importance of an adequate sexual history and testing of multiple sites in this group of patients.
Figure 7. Site of gonorrhoeal infection for men who have sex with men (MSM) (n=204)

Symptoms—More male cases presented with urogenital symptoms (85%) than female cases (66%). However this only applies to male urethral infection. If men had urethral infection, 93% were symptomatic—but if they did not have urethral infection, only 42% presented with symptoms. This is consistent with other studies indicating that pharyngeal and rectal infection with gonorrhoea is often asymptomatic.

Ciprofloxacin resistance—Results of antibiotic sensitivity testing were available on 197 cases of gonorrhoea. For the remaining 7 cases, results weren’t available because either testing was done by SDA (4 cases) or they were referred in for treatment from other providers (3 cases) and results of sensitivity testing could not be obtained.

Levels of ciprofloxacin resistance have been steadily rising in the Auckland region in the last 5 years, necessitating a change to ceftriaxone as the recommended empirical treatment for presumed gonorrhoea infection (Figure 8).

Figure 8. Ciprofloxacin resistance in the Auckland region (n=197)

Thirty-three percent of cases (65) during the study period were resistant to ciprofloxacin, thus reinforcing the need to continue using ceftriaxone as first-line treatment for gonorrhoea in Auckland when results of sensitivity testing are not available.
The majority of ciprofloxacin-resistant cases of *N. gonorrhoeae* were acquired within New Zealand (88%, Figure 9). Interestingly, ciprofloxacin resistance was also far more commonly diagnosed in heterosexuals (39%) than in MSM (3%). This indicates a separate sexual transmission network for MSM as would be expected.

**Figure 9. Acquisition of ciprofloxacin-resistant gonorrhoea**

![Graph showing the acquisition of ciprofloxacin-resistant gonorrhoea.](image)

**Results of gonococcal genotyping**

Sixteen ciprofloxacin-sensitive strains and 38 ciprofloxacin-resistant strains were sent to ESR, Wellington for strain typing by pulsed-field gel electrophoresis (PFGE).

PFGE is a highly discriminatory method for typing *N. gonorrhoeae* and can therefore be utilised in research into sexual networks. *N. gonorrhoeae* is a rapidly mutating organism that is capable of considerable antigenic variation of some of its outer proteins including lipopolysaccharide, pilin, and opacity proteins, the latter two being involved in host attachment.\(^5\) This explains its virulence and ability to reinfect individuals despite previous exposure.

*N. gonorrhoeae* has such a propensity for rapid mutation that isolates reported as having almost identical patterns can be regarded as originating from patients who are closely linked in a sexual transmission chain.\(^6\)

We utilised a cluster analysis based on a Dice coefficient grouped at 95% similarity. Using this method, 13 discrete gonococcal sub-types were identified in the ciprofloxacin-resistant group, with the largest proportion being identified as type A (31.5%) (Table 2).

Within this group of ciprofloxacin-resistant isolates there would have been patients that were linked in a sexual transmission chain. However this cannot be proven in most cases because sexual contacts of a particular patient are often not seen at ASHS or if they are seen at ASHS, they cannot necessarily be traced back to a particular index case. Notwithstanding this, within the largest identified cluster (type A) there were four patients who were definitely known to be sexual contacts of each other who were seen at ASHS. Two of these patients had isolates of the same type which confirmed that they were sexual contacts. One patient unfortunately had an isolate that was untypeable, and the other patient had a completely different strain (L), hence must have acquired their infection from another source.
Table 2. Prevalence of gonnococcal strains observed in cases

<table>
<thead>
<tr>
<th>Gonococcal strain</th>
<th>Number (percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>12 (32%)</td>
</tr>
<tr>
<td>E</td>
<td>6 (16%)</td>
</tr>
<tr>
<td>F</td>
<td>4 (11%)</td>
</tr>
<tr>
<td>W</td>
<td>6 (16%)</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>8 (22%)</td>
</tr>
<tr>
<td>Untypeable</td>
<td>1 (3%)</td>
</tr>
</tbody>
</table>

Although only a small number of cases were tested within the ciprofloxacin-sensitive isolates, there was much more genetic diversity, with 16 different strains identified among the 16 isolates that were tested. This result is expected, as ciprofloxacin-sensitive strains of gonorrhoea have been present in the population for a much longer time than ciprofloxacin-resistant strains so there has been more time for genetic recombination to occur.

Discussion

The most striking risk factors for gonorrhoea in this study were young age and being of Māori or Pacific ethnicity. Not surprisingly, reporting of multiple sexual partners within 3 months of diagnosis was also found to be a risk factor for gonorrhoea. Indeed, ESR clinic data and laboratory surveillance data both consistently indicate that rates for both gonorrhoea and chlamydia infection are highest in people under the age of 25. This is an internationally recognised phenomenon and is reflected in prevalence data from other developed nations.  

Young people tend to be at higher risk for sexually transmitted infections (STI) than older people in part because research shows that they have higher rates of new partner acquisition than older age groups, and this increases their probability of coming into contact with an infected person. 

ESR data also indicates that those of Māori and Pacific ethnicity are over-represented in statistics for gonorrhoea. Ethnic differences in gonorrhoea rates have also been reported in other countries. For example, epidemiological data from the United States and Britain report disproportionately higher rates of gonorrhoea in some ethnic groups such as African Americans or African Caribbeans. 

Other reported risk factors for gonorrhoea include low socioeconomic status, early onset of sexual activity, and a past history of gonorrhoea. Unfortunately this study was not designed to investigate reasons for ethnic differences in gonorrhoea acquisition so we cannot comment here in detail. Possible explanations could be ethnic differences in sexual behaviour as has been reported in British research, or there may be socioeconomic factors involved.

The protective role of condoms in lowering risk of STIs such as gonorrhoea has been supported by our results, although this is not a very robust finding because this study was retrospective and not designed to test that hypothesis. However, a recent prospective study of female adolescents has found that consistent condom use lowers risk of acquisition of both chlamydia and gonorrhoea. We therefore recommend that risk reduction strategies for gonorrhoea continue to emphasise the importance of
consistent condom use and regular sexual health checks for those who frequently change sexual partners. Furthermore, condoms should continue to be promoted because they have benefits in reducing risk of transmission of other STIs including human papilloma virus\textsuperscript{12} and HIV.\textsuperscript{13}

The importance of taking a full sexual history from patients requiring STI screens has been highlighted in this study, particularly for MSM, as pharyngeal and rectal infection with \textit{N. gonorrhoeae} is frequently asymptomatic. It is recommended, therefore, that specimens should routinely be taken from these sites depending on reported sexual practices.

Interestingly, it appears that many MSM do not seem to be aware that gonorrhoea is easily transmitted via oral sex and since using condoms for oral sex is unlikely to be an acceptable or practical option for most MSM, diagnosis of pharyngeal infection is important.

The majority of people diagnosed with gonorrhoea in our study had some sort of genitourinary (GU) symptom so it is important that people presenting with any type of GU symptom are offered a full range of STI tests. Prompt diagnosis and treatment of gonorrhoea is one of the major means of reducing transmission and prevalence of this infection.

A very worrying trend that has been noted in the Auckland region is the rapid rise in the prevalence of ciprofloxacin-resistance since the early 1990s. The laboratory at Auckland District Health Board (LabPlus) also receives isolates from Waitemata District Health Board for antibiotic sensitivity testing. Ciprofloxacin resistance was extremely rare in the Auckland region until 1994 when it was first reported, and after that the prevalence remained relatively stable at about 3\% for some years. In fact, most cases in the early 1990s were probably due to imported infection.

In 2001 there was an outbreak of ciprofloxacin-resistant \textit{N. gonorrhoeae} (CRNG) in South Auckland resulting in a sudden rise in prevalence to over 10\%. Since 2001 there has been an inexorable rise in the prevalence of CRNG, with approximately 19\% of all isolates sent for testing at LabPlus now being resistant to ciprofloxacin.

The results from this study have helped to establish that the majority of CRNG is now being acquired locally (88\%) rather than from overseas and that these strains are now endemic in our Auckland population. Interestingly the prevalence of CRNG at 33\% was even higher in our study subset of patients from ASHS, supporting our assumptions that we have a high-risk population accessing our clinics.

The rise in the prevalence of ciprofloxacin resistance in Auckland since the early 1990s, parallels the rise in the Western Pacific region, since quinolones became commonly used internationally as first-line treatment for gonorrhoea in the early 1990s. The Gonococcal Antimicrobial Surveillance Programme (GASP) collates resistance data from the Western Pacific Region and produces an annual report, and since its inception in 1994 GASP has reported a progressive increase in quinolone resistance in many countries.

In the mid-1990s, most countries in this region had a low prevalence of resistance except China, Korea, and Hong Kong, but by 2005 all countries except PNG had prevalences of between 20 and 95\%.\textsuperscript{14}
The extremely high rates of CRNG in Auckland are a potentially very serious issue as ceftriaxone is one of the few effective antibiotics available for treatment of CRNG, and although resistance to ceftriaxone has yet to be reported, it will be difficult to find alternatives in the future if this develops.

Further evidence that ciprofloxacin resistance is entrenched in the Auckland population comes from the results of the genotyping tests. In 2001 (at the time of the large initial outbreak), PFGR typing was requested on 25/42 (59%) CRNG isolates covering a 6-month period; 92% (23/25) of these isolates were reported as type A—the most common strain identified in our audit 2 years later (32%) (Brokenshire et al unpublished data). However, although type A was still predominant during the 2003 to 2004 time period in our study, there was much more genetic diversity with two-thirds of the isolates tested being of a different genotype to the type A strain.

In conclusion, the incidence of gonorrhoea in the Auckland population is steadily rising with the main risk factors being age under 25 and being of Māori or Pacific ethnicity. Ciprofloxacin resistance continues to rise and is nearly all acquired locally rather than overseas. Genetic diversity amongst ciprofloxacin-resistant isolates is increasing, indicating high levels of endemic infection in the Auckland population. Urgent action needs to be taken to control the current gonorrhoea epidemic in Auckland with more emphasis being placed on research to determine reasons for ethnic differences in gonorrhoea incidence.

**Competing interests:** None.

**Author information:** Sunita Azariah, Nicky Perkins; Sexual Health Physicians; Auckland Sexual Health Service, Greenlane Clinical Centre, Auckland District Health Board, Auckland

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**References:**


Chlamydia screening in Wellington Family Planning Association (FPA) clinics: a demonstration project

Margaret Sparrow, Hazel Lewis, Pauline Brown, Collette Bromhead, Dinusha Fernando, Alokananda Maitra

Abstract

Aims To demonstrate that enhanced screening for Chlamydia over and above the usual opportunistic screening in family planning (FPA) clinics is feasible, practical, and acceptable.

Methods Over a 6-month period from November 2004 to May 2005, all under-25-year-olds attending three Wellington FPA clinics in New Zealand were offered Chlamydia urine testing. Staff interviews before and after the study were carried out to assess the impact of enhanced screening on clinic routines. Interviews were conducted with 50 clients to assess the acceptability to young persons. Additional questions were asked of 22 Chlamydia-positive clients to ascertain the acceptability of the procedures for follow up.

Results From a total of 4674 participants, a valid urine test was carried out on 2533 (54%). The most common reason for exclusion was having passed urine in the last hour. Positive tests were detected in 212 (8%). A positive result was more likely in those with a history of partner change or in Māori and Pacific ethnic groups; it was least likely in those who always used condoms. For the staff, time constraints were the most important barrier to screening. The procedures were acceptable to clients.

Conclusions We demonstrated that improvements in Chlamydia screening are feasible, practical and acceptable to clients.

Chlamydia trachomatis infection is the most widespread bacterial sexually-transmitted infection in the world. Women sustain the most severe consequences of untreated infection—including pelvic inflammatory disease, chronic pelvic pain, ectopic pregnancy, and tubal infertility. Over the last two decades methods of testing and treatment have improved so that better control is possible; and because the disease is often asymptomatic, screening has become even more justifiable. Already, screening programmes have been introduced in England and Sweden. Indeed, recent editorials in this Journal have emphasised that chlamydia is a major problem in young persons in New Zealand.¹ ²

Since 2002, FPA clinics have had a policy of opportunistic screening for Chlamydia (especially where risk factors were identified), but it was acknowledged that large numbers of potentially infected clients remained unscreened. A demonstration project was thus designed to increase the level of screening.

Methods

This study was carried out in three FPA clinics in the Wellington region: Wellington, Lower Hutt, and Porirua. Ethical approval was obtained from the Wellington Medical Research Ethics Committee. All
under-25-year-olds were offered a urine test for Chlamydia at no extra cost, and 4674 participants were recruited. Recruitment took place over a 26-week period from 22 November 2004 to 20 May 2005.

A questionnaire, written information about the study, and a consent form were developed and pre-tested. These documents, a urine pot, free condoms, and the Ministry of Health pamphlet on chlamydia were offered to all participants. The questionnaire was designed to gain the following information: date of birth, gender, ethnicity, contact details, eligibility (under 25 years, sexual activity at least once, no antibiotic for last two weeks, at least one hour since last voiding urine), main reason for visit, partner change, condom use, reason for Chlamydia test, and whether any previous test for Chlamydia had been performed in the last 12 months.

Participants were instructed to provide a first-catch urine sample which was then transported to the laboratory at room temperature. Specimens were stored at -20°C overnight and then tested for Chlamydia trachomatis using the Roche Amplicor CT/NG PCR assay with Microwell Plate Detection. The presence of PCR inhibitors was monitored for all specimens, and all positive results were confirmed with a re-test the following day. Clients testing positive were advised and followed up by telephone to ascertain whether they and any partner(s) had been correctly treated.

In conjunction with the Chlamydia screening, qualitative research was conducted to ascertain the views of FPA staff. Semi-structured interviews were conducted individually both before and after the screening study by the study co-ordinator. To ascertain the acceptability of screening to young persons, telephone interviews were conducted with 50 clients representative of all age groups, gender, and ethnicities.

For the Chlamydia questionnaire and database, a web-based form was used. Descriptive analyses were carried out with Statistical Analysis Software (SAS) System (version 9.1).

**Results**

The FPA clinic clientele is predominantly European and female—this is reflected in the composition of the survey population (Table 1). For all ethnic groups, seeking hormonal contraception was the commonest reason for females to visit the clinic—except Pacific women, whose most common reason was for pregnancy testing. Males attended almost exclusively for a sexually transmitted infection (STI) check, sometimes as a result of partner notification following a positive test and sometimes on their own initiative.

Table 1. Demographic characteristics of the survey population

<table>
<thead>
<tr>
<th>Demographic characteristics</th>
<th>Included participants n=2559 (row %, column %)</th>
<th>Excluded participants n=2115 (row %, column %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>2462 (54,96)</td>
<td>2096 (46,99)</td>
</tr>
<tr>
<td>Male</td>
<td>97 (84,4)</td>
<td>19 (16,1)</td>
</tr>
<tr>
<td>Age group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10–14 years</td>
<td>41 (55,2)</td>
<td>33 (45,1)</td>
</tr>
<tr>
<td>15–19 years</td>
<td>1127 (55,44)</td>
<td>926 (45,44)</td>
</tr>
<tr>
<td>20–24 years</td>
<td>1391 (55,54)</td>
<td>1156 (45,55)</td>
</tr>
<tr>
<td>Age group II</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;16 years</td>
<td>131 (53,5)</td>
<td>115 (47,5)</td>
</tr>
<tr>
<td>≥16 years</td>
<td>2428 (55,95)</td>
<td>2000 (45,95)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>European</td>
<td>1747 (52,68)</td>
<td>1598 (48,75)</td>
</tr>
<tr>
<td>Māori</td>
<td>438 (64,17)</td>
<td>248 (36,12)</td>
</tr>
<tr>
<td>Pacific people*</td>
<td>151 (62,6)</td>
<td>91 (38,4)</td>
</tr>
<tr>
<td>Asian</td>
<td>96 (59,4)</td>
<td>67 (41,3)</td>
</tr>
<tr>
<td>Other</td>
<td>125 (56,5)</td>
<td>97 (44,5)</td>
</tr>
<tr>
<td>Unknown</td>
<td>2 (12,0,1)</td>
<td>14 (87,1)</td>
</tr>
</tbody>
</table>

*Mostly of Samoan, Tongan, Niuean, or Cook Islands origin.
4674 participants were in the survey population, with 2559 (55%) eligible for *Chlamydia* urine testing and 2115 (45%) being excluded (Table 1). Despite the efforts of receptionists to educate clients, the most common reason for exclusion was having passed urine within the last hour (31%). Almost as many (27%) were excluded because they had already been screened and considered that they had not been exposed to any risk since then. The numbers in this category increased towards the end of the study. The third most common reason for exclusion was not wishing to participate (11%). Reasons for not wishing to participate were not examined in detail but included time constraints, being in a stable relationship, having already been tested, or not being sexually active.

The survey population, reported condom use sometimes (34%), usually (35%), always (14%), and never (16%). Of those who never used condoms, we did not ask for details and were unable to distinguish between those involved in unsafe sex (with respect to both contraception and infection) and those who were using other contraception and not at risk of infection.

Most of the urine tests were performed on asymptomatic clients solely for screening purposes (70%). However the remaining 30% of individuals sampled were significantly more likely to have presented with symptoms warranting a screen for STIs, and to have had a partner change in the last 12 months. Both groups were equally likely to have had a previous *Chlamydia* test, with either a positive or negative result (Table 2).

A valid *Chlamydia* result was achieved for 2533 of the 2559 urine samples. Most samples (62%) were collected within at least 2 hours since last void. Of the participants with positive *Chlamydia* results, 65 (32%) had passed urine within 1 hour before being tested, while 141 (68%) had passed urine at least 2 hours before being tested. There was no significant difference between time since voiding (1 hour or 2 hours) and positivity.

### Table 2. Condom use, partner change, and previous *Chlamydia* testing

<table>
<thead>
<tr>
<th>Variables</th>
<th>Included participants (n=2559) (row %, column %)</th>
<th>Excluded participants (n=2115) (row %, column %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Used condom (always, usually or sometimes)</td>
<td>2134 (57,83)</td>
<td>1601 (43,76)</td>
</tr>
<tr>
<td>Change of sexual partner in the last three months</td>
<td>956 (67,37)</td>
<td>487 (33,23)</td>
</tr>
<tr>
<td>Change of more than two sexual partner in the last 12 months</td>
<td>1227 (62,48)</td>
<td>749 (38,35)</td>
</tr>
<tr>
<td>Had a previous <em>Chlamydia</em> test</td>
<td>967 (49,38)</td>
<td>989 (51,47)</td>
</tr>
<tr>
<td>Had a positive <em>Chlamydia</em> test result</td>
<td>233 (65,9)</td>
<td>124 (35,6)</td>
</tr>
<tr>
<td>Had symptoms warranting STI check</td>
<td>192 (100,7)</td>
<td>0 (0,0)</td>
</tr>
</tbody>
</table>

The results from this study indicate that the overall prevalence of *Chlamydia* in the Wellington region FPA clinics’ under-25 year-old population is 8%. Females were half as likely to have a positive *Chlamydia* test result as males (Table 3).
Table 3. *Chlamydia* prevalence, odd ratios [95% confidence intervals], and total valid *Chlamydia* urine tests by demographic characteristics

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>Tested positive (% of positive results)</th>
<th>Odd ratio [95% CIs] Chlamydia urine test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender †</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>15 (15)</td>
<td>1</td>
</tr>
<tr>
<td>Female</td>
<td>197 (8)</td>
<td>0.44 [0.25–0.78]**</td>
</tr>
<tr>
<td>Age group ††</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10–14 years</td>
<td>3 (8)</td>
<td>1</td>
</tr>
<tr>
<td>15–19 years</td>
<td>118 (11)</td>
<td>1.57 [0.47–5.23]</td>
</tr>
<tr>
<td>20–24 years</td>
<td>91 (7)</td>
<td>0.98 [0.29–3.29]</td>
</tr>
<tr>
<td>Ethnicity †††</td>
<td></td>
<td></td>
</tr>
<tr>
<td>European</td>
<td>113 (7)</td>
<td>1</td>
</tr>
<tr>
<td>Māori</td>
<td>61 (14)</td>
<td>2.32 [1.66–3.24]**</td>
</tr>
<tr>
<td>Pacific people</td>
<td>24 (16)</td>
<td>2.76 [1.71–4.45]**</td>
</tr>
<tr>
<td>Asian</td>
<td>6 (6)</td>
<td>1.08 [0.46–2.54]</td>
</tr>
<tr>
<td>Other</td>
<td>8 (6)</td>
<td>0.98 [0.46–2.06]</td>
</tr>
<tr>
<td>Unknown</td>
<td>0 (0)</td>
<td>–</td>
</tr>
</tbody>
</table>

*p<0.05, **p<0.01; ***p<0.0001; † Adjusted for age and ethnicity; †† Adjusted for gender and ethnicity; ††† Adjusted for gender and age.

The male:female ratio of the participants who tested positive with *Chlamydia* symptoms was 1:8—the ratio of those who tested positive with no symptoms was 1:14 thus indicating that (in our population) chlamydia in women is more often a “silent” infection.

*Chlamydia* prevalence did not differ significantly across the three age groups. Māori were over twice as likely, and Pacific people three times as likely, to test positive for *Chlamydia* compared to Europeans. *Chlamydia* prevalence did not differ significantly between Europeans, Asian, and other ethnic groups (Table 3).

Always using condoms was associated with a significantly lower *Chlamydia* prevalence, but usually (or sometimes) using condoms did not show any significant association with the *Chlamydia* test result (Table 4). Partner change was commonly associated with a positive test result. The odds of being tested positive for *Chlamydia* doubled when participants had a change of sexual partner in the last 3 months, and the risk was almost three times greater when participants reported sex with more than two partners in the last 12 months.

Table 4. *Chlamydia* prevalence, odd ratios [95% confidence intervals], and total *Chlamydia* urine tests by condom use and partner change

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>Prevalence</th>
<th>Tested positive (% of positive results)</th>
<th>Odd ratio [95% CIs] Chlamydia urine test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condom use †</td>
<td>Never</td>
<td>32 (8)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Always</td>
<td>9 (3)</td>
<td>0.35 [0.16–0.74]**</td>
</tr>
<tr>
<td></td>
<td>Usually</td>
<td>77 (8)</td>
<td>1.05 [0.68–1.64]</td>
</tr>
<tr>
<td></td>
<td>Sometimes</td>
<td>92 (10)</td>
<td>1.24 [0.81–1.91]**</td>
</tr>
<tr>
<td>Partner I †</td>
<td>No</td>
<td>91 (10)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>116 (7)</td>
<td>2.22 [1.65–2.99]**</td>
</tr>
<tr>
<td>Partner II †</td>
<td>No</td>
<td>63 (5)</td>
<td>2.58 [1.88–3.55]**</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>143 (12)</td>
<td></td>
</tr>
</tbody>
</table>

*p<0.05, **p<0.01; ***p<0.0001; † Adjusted for gender, age, and ethnicity. Partner I – had a change of sexual partner in the last three months. Partner II – had sex with more than two partners in the last 12 months.
In the follow-up, 147 clients’ partners were successfully notified (69%). The client notified 141 partners, while the clinician notified 6 of the partners. Of the notified partners, 100 (68%) were known to have received treatment from FPA or elsewhere. Interviews were conducted by the study coordinator at the beginning and again at the end of the study with receptionists (11 before, 9 after) nurses (9 before, 11 after), and doctors (7 before and after). All staff considered that screening for *Chlamydia* in under 25-year-olds was important. Most had to make adjustments with their working schedule, although their screening practice improved with time.

Finding time within the consultation was the greatest barrier for doctors and nurses; another was prioritising the needs of patients, especially when they presented with more urgent problems. Before the study, many staff were apprehensive about the possibility of causing offence or experiencing difficulties at reception, but in reality few problems were encountered. Follow-up of clients with positive results was sometimes time-consuming and difficult.

Most clients already knew something about chlamydia but they reported that their knowledge increased as a result of the study. Most participants read the documents they were given and were satisfied with the amount of information they received. Although the policy was to advise young persons when making an appointment, a majority stated that they had not heard about the study before coming for their appointment. Friends were rated as an important source of information but overall did not report telling other friends about the availability of screening.

No study participants reported feeling pressured into taking part in the study nor felt judged in any way by staff. Although the majority felt there was adequate privacy, there were a few negative comments confirming the importance of privacy and confidentiality “I would have preferred to be asked in the consulting room and not in reception.” “The specimen pot should only have been given to those who accepted screening.” Generally there were no difficulties in filling out the questionnaires or in providing a urine sample. Clients who returned were not offended to be asked about re-screening.

Of those women testing positive, nearly half had not thought about the consequences of a positive result, and 13/21 (62%) were unprepared and shocked by the result. When partners were informed, there was a wide variation in response. Although 4/21 were unable to contact their partner(s), most chose to tell their partner in person. There was variation in whether a positive test had an adverse effect on the relationship and in about half the cases, the question of unfaithfulness came up. Eight persons had swabs for other STIs taken at the time of the test, but it was disappointing that 5 out of 21 persons did not return for a full STI check. Most people did not have difficulty with treatment, and preferred the single-dose azithromycin treatment. Lastly, most did not have ongoing concerns about their health or fertility.

**Discussion**

We have demonstrated that with relevant staff training a more intensive *Chlamydia* screening programme can be successfully introduced into busy family planning clinics. The practice is well accepted by clients, and the data generated from this study will be relevant to other primary healthcare providers as well as those concerned with
public health policy. In general practice, where people are not necessarily attending for sexual issues, patients will not be offended if questions are asked with sensitivity and if it is clear that the offer to test is a routine matter.\textsuperscript{20}

This study showed a \textit{Chlamydia} prevalence of 8\% in under-25-year-olds. How does this compare with other New Zealand studies? The first 1983 study of females attending the Auckland STD clinic reported a prevalence of 19\%.\textsuperscript{4} Soon afterwards, the first FPA study in Christchurch of 500 endocervical samples found a prevalence of 15.8\%.\textsuperscript{5}

A second 1984–85 FPA Christchurch study of 2000 endocervical swabs reported 17.5\%;\textsuperscript{6} while 10 years, later the prevalence had decreased to 5.8\%.\textsuperscript{7} In 200 asymptomatic army recruits (published 1991), the \textit{Chlamydia} prevalence was 4\%\textsuperscript{,}\textsuperscript{8} but in Christchurch secondary schools (published 2003), the prevalence was only 2\%.\textsuperscript{9} In pregnant Wellington women (1999–2000), 4.8\% were positive—with a higher incidence in younger women, Māori, and Pacific peoples.\textsuperscript{10}

In 2003, a study of female university students found that 2.7\% were positive for \textit{Chlamydia}.\textsuperscript{11} In the \textit{ESR Annual Surveillance Report 2005},\textsuperscript{12} the prevalence rate of \textit{Chlamydia} in sexual health clinics was 5.7\%, in family planning clinics 1.5\%, and in student and youth health clinics it was 0.4\%. The difficulties in collecting this data are acknowledged, and hence there is the likelihood of under-reporting of the incidence of \textit{Chlamydia}.

Many of the clients in this study would have gone unscreened with previous patterns of testing. The number of \textit{Chlamydia} urine tests for the period January to April in 2004 was 624 compared to 987 for the same months during the study in 2005. Our task now is to take the information, and that of others in the field, and develop strategies for reducing the barriers to screening.

Funding issues are frequently mentioned as barriers to screening but were not examined in this study. An important undertaking will be to promote an attitude shift in clinical staff from detecting suspected infections in those with known risk factors to proactively offering screening to all under-25-year-olds. Recently, FPA nurse Rose Stewart published an article\textsuperscript{13} demonstrating how self-audit improved her screening practice.

Trained receptionists are essential for a successful screening programme. Based on attendance patterns, we gained information about where screening is most likely to be effective. For young women, combining screening with requests for hormonal contraception and pregnancy tests is practical. Requests for emergency contraception are more likely to be in busy clinics where the pressure of work is a barrier to screening, although this is a group that will often require a return visit for a full STI check.

Time can be saved by using a computer alert to remind staff of the need to screen under-25-year-olds annually while avoiding re-asking clients who have recently been screened. Some programmes in overseas countries recommend that women who have previously tested positive for \textit{Chlamydia} require more frequent testing at 6-monthly intervals.\textsuperscript{14}

Another possibility is to offer self-taken vaginal swabs for women\textsuperscript{15} who may find this option acceptable, especially when they have passed urine within the last hour.
The necessity for waiting 2 hours is currently under review, as the time interval is a definite barrier to testing. A recent study of men in Edinburgh showed that a voiding interval less than 2 hours had no impact on the sensitivity of the test, but this could not be extrapolated to women.\textsuperscript{16} We found that collecting urine specimens only 1 hour since last void did not affect the likelihood of having a positive result.

The role of nurses is pivotal for a successful screening programme and in this study the assistance of nurses in following up positive cases was much appreciated. An English study also found the involvement of practice nurses improved the follow-up of partners.\textsuperscript{17} The follow-up of those testing positive could be improved, and greater use of cell phones and texting could improve the follow-up of a young mobile clientele.

One of the messages received from the interviews with young clients was that screening must be supported by health education programmes to increase public awareness of chlamydia and other sexually-transmitted infections. Without these education programmes, screening for \textit{Chlamydia} has the potential to give false reassurance about other STIs.

In the future we may see programmes that are less dependent on medical practitioners such as internet, postal, or pharmacy-based programmes.\textsuperscript{18,19}

\textbf{Competing interests:} None.

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\textbf{Acknowledgments:} The research was made possible with funding from the New Zealand Family Planning Association, the Wellington Medical Research Foundation Inc, the Ministry of Health, and Roche Diagnostics New Zealand Limited. We thank all the FPA staff and clients who participated as well as the staff of the ESR and Aotea Pathology Wellington.

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\textbf{References:}


Health outcomes for diabetes patients returning for three annual general practice checks

Andrew Tomlin, Susan Dovey, Murray Tilyard

Abstract

Aim To measure changes in the health status of 840 Type 1 and 9998 Type 2 diabetes patients who had completed three free annual diabetes reviews by December 2005.

Method We evaluated changes in clinical measures and differences in proportions of patients achieving guideline targets between the first and third reviews. Logistic regression analysis examined variables associated with an absolute decrease in HbA1c level of at least 1% from the first to the third review.

Results The proportion of patients achieving guideline targets for glycaemic control fell from 17.1% to 12.2% for Type 1 diabetes (p=0.004) and from 56.1% to 50.2% for Type 2 diabetes (p<0.001). There were significant improvements in mean albumin:creatinine ratio, total cholesterol, and high density lipoprotein levels in both diabetes cohorts and mean blood pressure and triglyceride levels in Type 2 patients. Adjusted odds of improved glycaemic control were higher for Type 2 diabetics treated with oral medication only (OR=4.27 [95%CI: 3.45–5.14]), insulin only (OR=7.10 [95%CI: 5.58–9.04]), and insulin and oral therapy (OR=10.05 [95%CI: 7.72–13.09]).

Conclusion The introduction of a structured and systematic general practice review process aimed at improving diabetes care and patient outcomes resulted in significant improvements in mean blood pressure, cholesterol levels, and albumin:creatinine ratio. There was, however, no overall improvement in glycaemic control.

The increasing prevalence of diabetes mellitus worldwide has prompted investigations of primary care initiatives aimed to improve the quality of care provided to patients with diabetes. These initiatives are often facilitated by diabetes registers and general practice networks monitoring the care provided to diabetes patients. In conjunction with implementing clinical guidelines for improved diabetes care, they constitute quality improvement mechanisms aimed at minimising adverse health consequences for people with diabetes.

There is less research about changes in the health status of patients monitored as part of these initiatives, and evidence of diabetes outcomes is variable, particularly with regard to glycaemic control, and the proportion of patients achieving targets set in guidelines. Furthermore, results often focus on patients with Type 2 diabetes, due both to its greater prevalence than Type 1 insulin-dependent diabetes, and because of its preventability. The incidence of Type 1 diabetes is also increasing worldwide, however.

In New Zealand, the Ministry of Health launched a programme in 2000 to monitor and improve care and outcomes for people with diabetes. Under this programme, patients are provided with a free annual consultation for their diabetes and, at each
review, a doctor or practice nurse collects demographic and clinical data about the patient and their diabetes.

Although diabetes registers were already established in many New Zealand general practices, primary care organisations supplemented these registers with centralised rolls as a key component of the Ministry programme.

South Link Health, an independent practitioner organisation with 498 South Island general practitioner members, established a diabetes review process for their practices in August 2000. We used data from this diabetes register in the current study.

The effectiveness of interventions to improve chronic disease management may be judged by improvements in patient health over several years. In this research, we examine whether there have been significant changes in the clinical health status of Type 1 and Type 2 diabetes patients enrolled on the South Link Health Diabetes Register across the first 3 years of free diabetes health checks. We also determine the proportion of patients achieving treatment target levels for diabetes care in New Zealand and consider changes in outcomes compared with similar initiatives in other countries.

Method

Study data—Patients listed on practice diabetes registers were invited to attend their practice for an initial diabetes review and to give written consent for their data to be used for research and structured feedback reports to practices. General practitioners were reimbursed for the consultation by the Ministry of Health and South Link Health so that visits were free for patients.

At the first diabetes check, and at each subsequent annual review, data relating to patients and their clinical characteristics were entered onto a standard paper data collection form. Demographic information included date of birth, sex, and ethnic group. Clinical data included type of diabetes, year of diagnosis, weight, height, smoking history, HbA1c level recorded within the last 6 months, blood pressure, albumin/creatinine ratio, fasting total cholesterol, triglycerides and high density lipoprotein (HDL) levels, and diabetic therapy.

Information concerning whether the patient was taking an angiotensin-converting-enzyme inhibitor (ACE inhibitor), an HMG-CoA reductase inhibitor (statin) to control lipids, and whether a foot examination had taken place within the last 12 months was also collected along with details of the most recent retinal screening or ophthalmologist examination.

Study groups—In this study, we focused on changes in the health status of two patient groups: patients with Type 1 and Type 2 diabetes. All patients in both study groups had completed at least three diabetes reviews, and analysis was undertaken on repeated measurements for each patient. Initial reviews took place between September 2000 and December 2003 and patients were included if their third review had been completed by December 2005. By this time, 1634 Type 1 diabetes patients and 16,987 Type 2 diabetes patients had presented for a first diabetes examination. Of these, 6211 patients (33.4%) were not due for their third diabetes review by December 2005, and 1572 (8.4%) were overdue.

The current analysis concentrated on the 840 Type 1 patients (51%) and 9998 Type 2 patients (59%) who had completed three diabetes reviews.

Clinical measures—Diabetic therapy groups were defined as insulin only, insulin and oral hypoglycaemics, oral hypoglycaemics only, and diet only. Smoking status was defined in the register as current smoker (smoking within the last 6 months), past smoker, or never smoked.

In this analysis we calculated the proportion of current smokers. We also determined the percentage of patients receiving an eye examination within the last 2 years and a foot examination within the last 12 months, and the proportion of patients prescribed anti-hypertensive and lipid-lowering medication.

Body Mass Index (BMI) was calculated as weight (kg) divided by height (cm) squared.

Outcome measures—For interventions in people with diabetes in New Zealand, we determined the percentage of each study group achieving target levels. Optimal target levels for cardiovascular
disease are HbA1c <7.0%, blood pressure <130/80 mmHg, total cholesterol <4 mmol/L, HDL cholesterol >1 mmol/L, and triglycerides <1.7 mmol/L.

Female patients with an albumin:creatinine ratio ≥3.5 mg/mmol and male patients ≥2.5 mg/mmol were classified as having microalbuminuria. The European Diabetes Policy Group Guidelines were used to classify patients as being at either “low” or “high” risk for microvascular complications. Patients with cholesterol <4.8 mmol/L, triglycerides <1.7 mmol/L, and HbA1c <6.5% were classified as at low risk. Those with cholesterol >6.0 mmol/L, triglycerides >2.2 mmol/L, and HbA1c >7.5% were classified at high risk.

Statistical analysis—Differences in clinical and health status measures at the first and third diabetes reviews were estimated using student’s t-tests for paired samples (continuous data) or the Chi-squared test for differences in proportions. Logistic regression analysis was used to examine the relationship between improved glycaemic control and demographic and diabetes treatment variables for patients with Type 1 and Type 2 diabetes separately. The binomial outcome variable was an absolute decrease in HbA1c level of at least 1% from the first to the third review.

Independent variables in the regression models were age, sex, years since diagnosis of diabetes, current smoking status, decrease in BMI between the first and third reviews, and diabetes therapy. The level of significance for statistical tests was 0.05.

Results

At their first diabetes check, the mean age of patients with Type 1 and Type 2 diabetes was 43.8 years and 65.2 years respectively. Males comprised 55.7% of the Type 1 cohort and 50.3% of the Type 2 cohort.

Mean BMI increased between the first and third diabetes reviews in Type 1 patients of both sexes, and decreased for Type 2 females but not for males. The percentage of Type 2 diabetes patients currently smoking decreased from 11.4% to 10.4%, but there was no significant decrease in smoking among Type 1 diabetics (Table 1).

Diabetes therapy for 419 Type 2 patients (4.2%) was changed from diet or oral-medication-only to insulin-only or insulin-and-oral-hypoglycaemics. Twenty-four patients with Type 1 diabetes (2.8%) changed from insulin-only treatment to insulin plus oral hypoglycaemic medication. There were significant increases in the proportion of patients prescribed ACE inhibitors and statins in both diabetes types.

Changes in glycaemic control—As shown in Table 2, there was a significant increase in mean HbA1c levels in Type 2 diabetes patients (7.2 to 7.3%), but not in Type 1 patients (8.4 to 8.5%).

The proportion of patients achieving the New Zealand guideline treatment level for glycaemic control (HbA1c ≤7%) fell from 17.1% to 12.2% for Type 1 diabetes and from 56.1% to 50.2% for Type 2 diabetes. In the Type 2 cohort, the percentage of patients with poor glycaemic control (HbA1c >9%) also decreased from 10.7% to 9.5% (p<0.01).

Figure 1 indicates that improvements in glycaemic control between the first and third diabetes reviews were mostly achieved by patients with initial HbA1c levels of greater than 8%, and that most of the improvement occurred between the first and second annual checkups.

Seventy-one percent of all diabetes patients with HbA1c >8% at the first review, and 79% with HbA1c >9%, responded to treatment with a lowered reading by the third checkup. The mean reduction in HbA1c was from 9.5 to 8.5% and from 10.5 to 8.9% for these two patient groups.
Table 1. Patient characteristics by diabetes type

<table>
<thead>
<tr>
<th>Variables</th>
<th>Type 1 diabetes (n=840)</th>
<th>Type 2 diabetes (n=9998)</th>
<th>P value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration of diabetes (years)</td>
<td>20.2 (13.7)</td>
<td>21.4 (13.6)</td>
<td>22.6 (13.7)</td>
</tr>
<tr>
<td>Smokers (%)</td>
<td>19.9</td>
<td>18.0</td>
<td>18.7</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>25.9 (4.2)</td>
<td>26.1 (4.1)</td>
<td>26.4 (4.3)</td>
</tr>
<tr>
<td>Males</td>
<td>27.1 (6.1)</td>
<td>27.5 (6.3)</td>
<td>27.6 (6.3)</td>
</tr>
<tr>
<td>Therapy (%)</td>
<td>97.1</td>
<td>96.0</td>
<td>94.3</td>
</tr>
<tr>
<td>Insulin only</td>
<td>2.9</td>
<td>4.0</td>
<td>5.7</td>
</tr>
<tr>
<td>Insulin and oral medication</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Oral medication only</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Diet only</td>
<td>31.8</td>
<td>38.5</td>
<td>42.5</td>
</tr>
<tr>
<td>ACE inhibitor use (%)</td>
<td>12.6</td>
<td>24.2</td>
<td>32.5</td>
</tr>
<tr>
<td>Statin use (%)</td>
<td>94.7</td>
<td>95.7</td>
<td>96.6</td>
</tr>
<tr>
<td>Foot check (%)</td>
<td>86.1</td>
<td>84.4</td>
<td>85.6</td>
</tr>
</tbody>
</table>

Data are mean (SD) or % of patients. *For differences between 1st and 3rd reviews.
Table 2. Clinical characteristics by diabetes type

<table>
<thead>
<tr>
<th>Variables</th>
<th>Type 1 diabetes (n=840)</th>
<th>Type 2 diabetes (n=9998)</th>
<th>P value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>HbA1c (%) ≤7.0 (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blood Pressure (mmHg)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systolic</td>
<td>128.0 (19.1)</td>
<td>128.0 (18.7)</td>
<td>127.9 (18.3)</td>
</tr>
<tr>
<td>Diastolic</td>
<td>74.2 (9.9)</td>
<td>73.8 (9.7)</td>
<td>73.4 (10.3)</td>
</tr>
<tr>
<td>&lt;130/80 (%)</td>
<td>37.5</td>
<td>40.3</td>
<td>40.2</td>
</tr>
<tr>
<td>Albumin:creatinine (mg/mmol)</td>
<td>9.9 (37.8)</td>
<td>9.9 (38.0)</td>
<td>8.3 (31.1)</td>
</tr>
<tr>
<td>Males &gt;2.5 (%)</td>
<td>26.2</td>
<td>24.8</td>
<td>22.4</td>
</tr>
<tr>
<td>Females &gt;3.5 (%)</td>
<td>27.1</td>
<td>21.8</td>
<td>20.5</td>
</tr>
<tr>
<td>Cholesterol (mmol/L) &lt;4.0 (%)</td>
<td>5.2 (1.1)</td>
<td>5.1 (1.0)</td>
<td>4.9 (1.0)</td>
</tr>
<tr>
<td>HDL (mmol/L) &gt;1.0 (%)</td>
<td>1.5 (0.5)</td>
<td>1.6 (0.5)</td>
<td>1.6 (0.5)</td>
</tr>
<tr>
<td>Triglycerides (mmol/L) &lt;1.7 (%)</td>
<td>1.2 (0.8)</td>
<td>1.3 (1.0)</td>
<td>1.2 (1.0)</td>
</tr>
<tr>
<td>Microvascular complications (%)</td>
<td>3.7</td>
<td>3.2</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Data are mean (SD) or % of patients. * for differences between 1st and 3rd reviews.
Changes in blood pressure, albumin/creatinine and blood lipid levels—Mean systolic blood pressure levels decreased in Type 2 diabetes patients (141.1 to 139.4 mmHg) and mean diastolic blood pressure in both Type 1 diabetes patients (74.2 to 73.4 mmHg) and Type 2 diabetes patients (79.1 to 77.3 mmHg). There was a significant increase in the proportion of Type 2 patients achieving the guideline level for blood pressure (130/80 mmHg) from 14.5% to 17.5%, but no significant increase in Type 1 diabetics.

Although albumin:creatinine ratios decreased in both patient groups, there was no significant change in the proportion of males or females with microalbuminuria. Blood lipid levels improved in both diabetes types with mean total cholesterol decreasing from 5.2 to 4.9 mmol/L among Type 1 diabetes patients and from 5.4 to 4.9 mmol/L among Type 2 diabetes patients.

Mean HDL levels increased in both patient groups. The proportion of patients at high risk for microvascular complications decreased from 3.7% to 2.0% of Type 1 diabetes patients and from 4.4% to 2.2% of Type 2 diabetes patients. There was no change in the proportion of patients at low risk in either cohort.

Variables associated with improved glycaemic control—Results from multivariable logistic regression analysis of Type 1 and Type 2 diabetes patients showing the likelihood of an improvement in HbA1c level of at least 1% between the first and third reviews are presented in Table 3. Odds ratios were adjusted for age, sex, duration of diabetes, current smoking status, decreases in BMI between the first and third reviews, and diabetes treatment regimen.

For Type 2 diabetes patients, the odds of improved glycaemic control were at least 23% lower for those over 60 years of age than those under the age of 50 years. The
odds for patients with a reduced BMI were 82% higher than for those with no reduction.

Table 3. Logistic regression models for improvement in glycaemic control between 1st and 3rd annual diabetes reviews

<table>
<thead>
<tr>
<th>Variables</th>
<th>Type 1 Diabetes N</th>
<th>OR (95% CI)†</th>
<th>Type 2 Diabetes N</th>
<th>OR (95% CI)†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age 25-39 years</td>
<td>308</td>
<td>1.00</td>
<td>1052</td>
<td>1.00</td>
</tr>
<tr>
<td>40-49 years</td>
<td>333</td>
<td>0.98 (0.73-1.33)</td>
<td>1596</td>
<td>0.88 (0.74-1.08)</td>
</tr>
<tr>
<td>50-59 years</td>
<td>160</td>
<td>0.63 (0.22-1.23)</td>
<td>445</td>
<td>0.57 (0.44-0.79)</td>
</tr>
<tr>
<td>≥60 years</td>
<td>150</td>
<td>0.64 (0.46-1.44)</td>
<td>1052</td>
<td>0.63 (0.42-0.97)</td>
</tr>
<tr>
<td>Duration of diabetes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;10 years</td>
<td>216</td>
<td>1.00</td>
<td>2723</td>
<td>1.00</td>
</tr>
<tr>
<td>10-19 years</td>
<td>228</td>
<td>1.44 (0.87-2.35)</td>
<td>3024</td>
<td>0.49 (0.41-0.57)</td>
</tr>
<tr>
<td>20-29 years</td>
<td>154</td>
<td>1.24 (0.71-2.16)</td>
<td>1758</td>
<td>0.53 (0.44-0.63)</td>
</tr>
<tr>
<td>≥30 years</td>
<td>212</td>
<td>0.70 (0.35-1.40)</td>
<td>2490</td>
<td>0.47 (0.39-0.58)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>428</td>
<td>0.85 (0.58-1.25)</td>
<td>5025</td>
<td>0.80 (0.60-1.04)</td>
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<tr>
<td>Male</td>
<td>372</td>
<td>1.00</td>
<td>4973</td>
<td>1.00</td>
</tr>
<tr>
<td>Current smoker</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>No</td>
<td>683</td>
<td>1.00</td>
<td>889</td>
<td>1.00</td>
</tr>
<tr>
<td>Yes</td>
<td>157</td>
<td>1.49 (0.95-2.33)</td>
<td>1039</td>
<td>1.00 (0.83-1.20)</td>
</tr>
<tr>
<td>BMI decrease†</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>671</td>
<td>1.00</td>
<td>7210</td>
<td>1.00</td>
</tr>
<tr>
<td>Yes</td>
<td>163</td>
<td>0.59 (0.35-1.02)</td>
<td>2757</td>
<td>1.82 (1.41-2.35)</td>
</tr>
<tr>
<td>Diabetes therapy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulin only</td>
<td>797</td>
<td>1.00</td>
<td>2940</td>
<td>1.00</td>
</tr>
<tr>
<td>Insulin and oral mode</td>
<td>43</td>
<td>1.31 (0.30-2.97)</td>
<td>334</td>
<td>1.34 (0.34-5.14)</td>
</tr>
</tbody>
</table>

†For decrease in Hba1c(%) of ≥1%; ‡Between 1st and 3rd diabetes reviews; *Estimate significant at p<0.05.

Patients on insulin or insulin and oral hypoglycaemics were at least seven times more likely to achieve a clinically significant reduction in Hba1c level than patients controlling their diabetes by diet only. For Type 1 diabetes patients, the odds of improved glycaemic control were over 50% lower for patients between the ages of 40 and 60 years than for patients under 40 years of age.

Conclusion

This study demonstrates that the introduction of a structured and systematic general practice review process aimed at improving diabetes care and patient outcomes is associated with significant improvements in the health status of both Type 1 and Type 2 diabetes patients. Mean blood pressure, cholesterol levels, and albumin:creatinine ratio were reduced in both patient groups while the proportion of patients meeting national guidelines for blood pressure, total cholesterol, and HDL increased.

There were significant increases in the proportion of patients prescribed antihypertensive and lipid-lowering medication. Statin-use more than doubled from the first to the third diabetes review. The Type 2 diabetes group also showed improvements in mean BMI, a reduction in patients currently smoking, and increases in the proportion of patients receiving a foot check in the last 12 months and an eye examination in the last 2 years.
These changes are clinically as well as statistically significant. For example, at the first review, 35.5% of patients with Type 2 diabetes had a 5-year cardiovascular event risk of greater than 20%—but in the third review only 18.3% fell into this same high risk group.

If there are 104,000 New Zealanders with Type 2 diabetes\textsuperscript{20} this result suggests that after 3 years’ engagement in the program, about 18,000 will have moved from high to lower risk of cardiovascular events. There was, however, no overall improvement in glycaemic control in either patient group.

Comparable data from the Swedish National Diabetes Register showed an improvement in mean HbA1c from 7.8 to 7.2% in patients registered with Type 2 diabetes from 1996 to 2003,\textsuperscript{16} although this finding did not reflect repeated measurements on all patients.

Results from the NHANES surveys of over 8 million Type 2 diabetes patients in the USA, however, showed a mean HbA1c increase from 7.7 to 7.9% from 1988–1994 to 1999–2000.\textsuperscript{17} In comparison to the Swedish study in which 35% of Type 2 patients were treated with insulin or insulin and oral hypoglycaemic agents by 2003, only 16% of Type 2 diabetics in the South Link Health programme were treated with insulin at the time of the third diabetes review.

In patients changing therapy from diet or oral medicines only to insulin, mean HbA1c decreased from 8.5% to 8.2% thus indicating that more aggressive treatment may be necessary to improve levels of glycaemic control for some patients. Further evidence for this conclusion was provided by the logistic regression analysis which demonstrated that the odds of an improvement in HbA1c of 1% was 10 times greater for patients on insulin and oral drugs than patients treated by diet alone, and 7 times greater for patients using insulin only. In the Type 2 cohort, the results also indicate that deterioration in glycaemic control may reflect the ageing of patients and the increasing duration of diabetes across the 3 study years.

Improvements in glycaemic control were most notable in patients with high HbA1c levels at the first review. General practitioners may have targeted these patients for special attention but whether this was the case is unknown. Under a new initiative, patients with HbA1c levels greater than 8% at their last two diabetes reviews are now provided with an additional review every 6 months. Closer monitoring of lifestyle factors and glycaemic control in these patients is a priority.

This current analysis has some limitations. There is a small likelihood of error in the assignment of diabetes type either by general practitioners or in data entry on the diabetes register. Six patients recorded as Type 1 on the register were on oral medication or diet only and so were reassigned to the Type 2 group. We estimate the error associated with misassignment as small, and no Type 2 patients on diet or oral medications only should be in the Type 1 group.

This study examines health status measures limited to objective measures only—including other indicators of health such as quality of life and social functioning may have provided a more complete assessment of health. Additionally, we cannot entirely attribute the changes we observed to the diabetes review program, as the influence of generally increased awareness of the need to control blood pressure and cholesterol would also have contributed to the results we report here.
The diabetes patients in this study represent a large cohort by international standards and we have focused on repeated measurements of clinical indicators in a cohort of all diabetes patients registered to more accurately ascertain changes in health status due to the introduction of free annual diabetes examinations.

Data collection was standardised across all participating practices and there were few missing data. At the time data was collated for this study, there were 18,621 patients with Type 1 or Type 2 diabetes who had completed a first diabetes review (a quarter of whom had completed four annual examinations), thus enabling future research to include larger cohorts over a greater time span.

New data now being collected for each patient as part of the programme include known diabetic complications and cardiovascular events; low-density lipoprotein (LDL) levels; and whether metformin, sulphonylurea, or other oral medication was administered.

The diabetes annual general practice checks are different from other population-based programs run in general practice because they are focused on longitudinal management of an already diagnosed chronic disease, whereas other programs (such as cervical screening) seek primarily to diagnose new cases.

Population-based programs are not a core function of general practice where the fundamental focus is on individual patient care. Indeed, there may be tensions when individual patients fail to perceive benefits from their engagement in a program targeted to benefitting a population. Ways to resolve these tensions require further research.

The quality of care provided to patients participating in the annual diabetes review programme is improving. The number of patients prescribed medication to control high blood pressure and blood lipid levels increased significantly by the third review as did the proportion of patients receiving retinal examinations and foot checks. In addition, there was a decrease in the number of Type 2 diabetes patients currently smoking.

There were significant improvements in some outcome measures including blood pressure, cholesterol, and albumin:creatinine ratio but no evidence of improved glycaemic control in either Type 1 or Type 2 diabetes patients.

Competing interests: None.

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References:


Treatment of anaphylaxis in adults: results of a survey of doctors at Dunedin Hospital, New Zealand

Suzy Thain, Jill Rubython

Abstract

Aims To identify which medications doctors would prescribe when treating an adult patient with anaphylaxis, and to ascertain the dose and route of administration of adrenaline they would use.

Method Doctors of various grades working in a range of acute specialties at Dunedin Public Hospital (n=91) were asked to anonymously complete a questionnaire detailing two hypothetical cases of anaphylaxis.

Results 92% of participants would give adrenaline as first-line treatment to a patient with anaphylaxis, but only 20% knew the correct dose and route of administration according to the New Zealand Resuscitation Council (NZRC) or local hospital formulary guidelines. 43% of doctors surveyed stated they would give adrenaline by the intravenous (IV) route as first-line treatment with 20% proposing a dose of 1 milligram or greater.

Conclusion Most doctors surveyed were not clear about current anaphylaxis treatment guidelines. In particular, they were unsure of the recommended dose and route of administration of adrenaline. To ensure that the first-line treatment of anaphylaxis is safe, we recommend that intramuscular (IM) adrenaline should be used in the majority of situations in accordance with both NZRC and local hospital guidelines. We recommend that all doctors should receive regular education concerning the treatment of anaphylaxis.

Anaphylaxis is an acute, potentially life-threatening event requiring immediate recognition and treatment. The major life-threatening components of anaphylaxis are hypotension, bronchospasm, and upper airway angioedema. The most common of these is cardiovascular collapse.¹

Anaphylaxis can occur unexpectedly (with a wide variety of causes) in any age group, and all doctors should be aware of the immediate treatment. The cornerstones of management are the supine position, oxygen, adrenaline, and volume resuscitation.² The New Zealand Resuscitation Council (NZRC) and our hospital treatment guidelines regarding dose and route of adrenaline to be used when treating anaphylaxis in adults are outlined in Figure 1.

Whilst adrenaline is life-saving, it is also potentially dangerous. It increases heart rate, myocardial irritability, and inotropy predisposing the myocardium to potentially serious arrhythmias and ischaemia.¹

A previous study of hospital doctors showed that only 5% were able to state the correct dose and route of administration of adrenaline to use in anaphylaxis.³ The aims of this current survey were to identify which medications doctors working at our hospital would prescribe when treating an adult patient with anaphylaxis, and to
ascertain the dose and route of administration of adrenaline they would use. Use of an EpiPen®, second-line treatments, and knowledge of local guidelines was also investigated.

Figure 1. Guidelines for the treatment of anaphylaxis in adults; route of administration and dose of adrenaline

<table>
<thead>
<tr>
<th>New Zealand Resuscitation Council (NZRC) Guidelines:¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5 mg IM, 1:1000 solution (1 mg/ml)</td>
</tr>
<tr>
<td>Repeat after 5 minutes if no improvement</td>
</tr>
<tr>
<td>Life-threatening monitored reactions: IV adrenaline titration, 1:10,000 solution (0.1 mg/ml). Starting dose 1 ml (0.1 mg). Repeat this dose every minute and consider doubling the dose after three minutes if life-threatening shock persists.</td>
</tr>
</tbody>
</table>

| Dunedin Public Hospital Formulary Guidelines:        |
| Adrenaline IM 0.5 - 0.5 mg                          |
| In severe life-threatening reactions: IV adrenaline (1:10,000) 0.05–0.1 ml / kg |
| Repeat doses every 5–10 minutes until improvement occurs |

| Dunedin Public Hospital Anaesthetic Department Guidelines: |
| Adrenaline initial 200 mcg test IV                    |
| Subsequent boluses 10–20 mcg / kg, repeat approx each 5 minutes ± infusion |

Method

Ninety-one doctors working in Dunedin Public Hospital in May 2006 were selected at random during a 24-hour period. They were asked to complete a questionnaire under supervision which contained details of two hypothetical adult cases of anaphylaxis (see Appendix 1). The questions had been piloted by six volunteers who did not then participate in the survey. There was no compulsion to partake and subjects were informed that they were participating in a study. The responses were anonymous and participants were asked to specify their grade and specialty.

Results

Ninety-one questionnaires were completed by 9 consultants, 48 registrars, and 34 house surgeons. Participating doctors were working in the following specialties: emergency, medicine, surgery, anaesthetics, ENT, ophthalmology, paediatrics, obstetrics and gynaecology, radiology.

When questioned as to which first-line treatment should be given to a patient with anaphylaxis (Q1), 84 participants (92%) stated they would give adrenaline. Fifty-seven (63%) of all participants would give intramuscular (IM) adrenaline and 27 (30%) would give intravenous (IV) adrenaline; 5 participants (5%) chose to give IV hydrocortisone. One participant chose to give a salbutamol nebuliser and one chose to give IV fluid.

When asked the route of administration and dose of adrenaline to use when treating anaphylaxis (Q2), 44 participants (48%) stated that they would give adrenaline by the
IM route, 39 participants (43%) chose the IV route, and 4 (4%) chose the subcutaneous (SC) route; 4 participants stated that they did not know.

Of the 44 participants who elected to give adrenaline by the IM route, 18 knew the correct dose. Of the 39 participants who elected to give IV adrenaline, 13 knew the correct dose according to NZRC or local guidelines (Figure 1); 18 participants proposed an IV dose of 1 milligram (dose normally used in the management of cardiac arrest) or greater. Results are shown in Figure 2.

**Figure 2. Proposed route and dose of adrenaline [results of Question 2 (Q2)]**

![Bar chart showing proposed route and dose of adrenaline](image)

IM: Total number of participants proposing to give IM adrenaline; IM CD: number of participants proposing to give the correct dose of IM adrenaline; IV: total number of participants proposing to give IV adrenaline; IV CD: number of participants proposing to give the correct dose of IV adrenaline; Arrest dose: number of participants proposing to give 1mg or more IV adrenaline; SC: total number of participants proposing to give SC adrenaline.

When questioned about the timing of a second dose of adrenaline if the patient had not improved (Q3), 23 participants (25%) would give a second dose of adrenaline after 1 minute. Fifty-one participants (56%) stated that they would give a second dose after 5 minutes and eight participants (9 %) would give a second dose after 15 minutes.
Three people chose the “other” option, and times specified ranged from 20 minutes to 1 hour. Six people stated that they did not know when a second dose of adrenaline was appropriate. No participants stated that a second dose should never be given.

Table 1 shows the results for question two according to grade of doctor.

### Table 1. Proposed route and dose of adrenaline administered (Q2) according to grade of doctor

<table>
<thead>
<tr>
<th>Administration route</th>
<th>House Surgeons (n=34)</th>
<th>Registrars (n=48)</th>
<th>Consultants (n=9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IM</td>
<td>16</td>
<td>24</td>
<td>4</td>
</tr>
<tr>
<td>IM CD</td>
<td>4</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>IV</td>
<td>15</td>
<td>23</td>
<td>1</td>
</tr>
<tr>
<td>IV CD</td>
<td>3</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>Arrest Dose</td>
<td>7</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>SC</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Do not know</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

The responses given by participants regarding second line treatments for anaphylaxis, (Q4), are listed in Table 2.

### Table 2. Proposed second-line treatments for anaphylaxis

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Number of participants proposing to prescribe this</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corticosteroids</td>
<td>74</td>
</tr>
<tr>
<td>H1 antagonist / antihistamine</td>
<td>56</td>
</tr>
<tr>
<td>H2 antagonist / ranitidine</td>
<td>17</td>
</tr>
<tr>
<td>Nebulised salbutamol</td>
<td>18</td>
</tr>
<tr>
<td>IV fluid</td>
<td>16</td>
</tr>
<tr>
<td>Antibiotics</td>
<td>1</td>
</tr>
<tr>
<td>Nebulised adrenaline</td>
<td>2</td>
</tr>
<tr>
<td>Adrenaline infusion</td>
<td>2</td>
</tr>
</tbody>
</table>

When asked where a patient should be shown to inject their EpiPen (Q5), 52 participants (57%) would correctly show a patient to inject into their thigh. Sixteen participants (18%) chose the shoulder, 12 (13%) chose the abdomen, and 8 (9%) chose the buttock. Three people stated that they did not know.

When questioned about guidelines regarding anaphylaxis management (Q6), 59 participants (65%) were aware that hospital guidelines were available. Forty-eight participants (53%) correctly stated where the hospital guidelines could be found (Q7).

**Discussion**

The main aims of this study were to identify the medications that doctors would administer when treating an adult patient with anaphylaxis and in particular to ascertain the routes and doses of adrenaline that they would use. We assumed that basic management steps prior to drug administration would have occurred—i.e. stop administration of agent causing the reaction, administer high-flow oxygen, place the patient in supine position, and call for help.
When faced with a hypothetical patient with anaphylaxis, 92% of participants in this study stated that they would give adrenaline as their first line of treatment. The other 8% would give either IV fluid, IV hydrocortisone, or nebulised salbutamol. Although these are useful adjuncts in the treatment of anaphylaxis, the priority is to give adrenaline. This study has shown, however, that considerable confusion exists as to the most appropriate route of administration and correct dose of adrenaline to be used when treating anaphylaxis. This confusion applied to all grades of doctor surveyed.

In this study, adrenaline by the IV route was chosen by 32% and 43% of participants in response to Questions 1 and 2 respectively. This difference may be a reflection of the differences in the two scenarios outlined, with IV access already established in the second case. Nonetheless, current NZRC and our hospital formulary guidelines recommend that adrenaline by the IM route should be used as first line treatment in the majority of situations to treat anaphylaxis.

IM adrenaline is usually effective, can be given without delay, and it avoids the potentially lethal effects of large IV bolus injections. Recommendations suggest that the IV route is reserved for life-threatening shock, managed by experienced clinicians with adequate monitoring. Such monitoring tends to be in the intensive care, theatre, or emergency department settings.

Four participants proposed to give adrenaline by the subcutaneous (SC) route. However, this has been shown to give slow and unreliable absorption, and is not recommended.

This study has shown that many doctors are unaware of the correct dose of adrenaline to use when treating anaphylaxis. In response to Question 2, only 18 out of the 44 participants (20% of all participants) choosing the IM route, and 13 out of the 39 (14% of total) opting for the IV route actually knew the correct dose.

Alarminglly, 18 participants (20% of all participants) would give an IV dose of 1 milligram or more which is the dose used in the management of cardiac arrest. Given that so many participants proposed to give a potentially dangerous dose of IV adrenaline, this highlights the need to educate clinical staff to use IM adrenaline in most cases of anaphylaxis, as per current guidelines. This would ensure that the first line treatment of anaphylaxis was appropriate.

A wide variety of doses of both IM and IV adrenaline were proposed by participants. We believe that the existence of three different treatment guidelines within our hospital may be a factor contributing to the confusion surrounding the dosage and route of adrenaline. This is not unique to our hospital. We are aware that in another major hospital in New Zealand there exist three different guidelines in addition to the NZRC guideline (Personal Communication, Dr David Richards, 2007). We suggest that one treatment guideline (e.g. NZRC) should be adopted by all District Health Boards. If other guidelines are deemed necessary (such as in specialist areas), they should also be adopted nationally.

With regard to the site of administration of IM adrenaline, it is recommended that it should be given in the lateral thigh because absorption here appears more reliable than deltoid muscle. Self-injection into the buttock is impractical for patients and a recent study has shown that standard 25 mm and 35 mm needles do not reach the gluteal muscles in a considerable number of patients. In this study, 43% of participants...
would be unable to show a patient where to inject an EpiPen correctly, and presumably they would therefore also administer IM adrenaline incorrectly when treating anaphylaxis.

After adrenaline, other treatments recommended by Dunedin Hospital and the NZRC guidelines include IV fluids and nebulised salbutamol (if bronchospasm is present). Corticosteroids and H1 & H2 blockers (namely promethazine and ranitidine) are also recommended, although there is little evidence to support their benefit in anaphylaxis.  

In this study, the most commonly suggested second-line treatments (after the patient had improved with adrenaline) were corticosteroids and antihistamines. Far fewer participants would prescribe IV fluids or salbutamol. This is likely to reflect the clinical details described in the scenario—i.e. the patient was normotensive and had saturations of 99% on air.

This survey reflects the range of doctors who may be called upon to treat patients with anaphylaxis. We felt that this was important as all doctors should know how to treat this medical emergency. A larger study would permit differences between grades and specialties to be examined in more detail. This might allow exploration of the relationship between the various guidelines and proposed adrenaline management. In addition, more information could be obtained by performing a multicentred study including a survey of GPs, nurses, and other emergency response personnel.

**Conclusion**

This study has shown that when faced with an adult patient with anaphylaxis, most doctors surveyed would administer adrenaline as first-line treatment. Most were not clear as to the recommended dose and route of administration as per hospital guidelines.

In accordance with local and national guidelines, we recommend that adrenaline (as first-line treatment for anaphylaxis) should be administered by the IM route. (The IV route should be reserved for treating life-threatening shock by experienced clinicians with adequate monitoring.)

To avoid confusion and improve patient safety, we recommend that an EpiPen or pre-filled syringe with the appropriate dose of adrenaline is available in all adult resuscitation drug boxes throughout the hospital and that doctors should be taught how to use it appropriately. Furthermore, we suggest anaphylaxis management education should be given on a regular basis, and that all grades of doctor in all specialties be included. Ideally, only one guideline should be in general use within the hospital—and when others do exist such as in specialist areas, they should be in accordance with each other as much as possible. Finally, all doctors need to know where guidelines can be found quickly.

**Competing interests:** None.

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**Acknowledgements:** We thank all participating doctors at Dunedin Public Hospital as well as Dr David Richards (Consultant in Emergency Medicine, Christchurch Hospital).
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References:


Appendix 1 (Questionnaire) follows
Appendix 1. Questionnaire

Question 1
A 24-year-old man presents to the emergency department. He was stung by a bee and 2 minutes later he becomes acutely short of breath. On examination he is wheezy and has a widespread urticarial rash. His blood pressure is 80/50 and his face is swollen. What is your immediate first line of treatment? Choose only one of the following:

1. salbutamol nebuliser
2. IV hydrocortisone
3. IM adrenaline
4. IV fluid
5. IV adrenaline

Question 2
You are called to the ward. A 40-year-old patient with known penicillin allergy has just been given a dose of IV flucloxacillin. When you get there she is finding it difficult to breathe, her pulse is 120, and she is hypotensive, with saturations of 90% on oxygen. You ask the nurse to get some adrenaline.

1. what dose would you give?
2. what concentration of adrenaline would you use?
3. by what route would you administer this?

Question 3
When, if ever, can you use a second dose of adrenaline?

1. after 1 minute if the patient does not improve
2. after 5 minutes if the patient does not improve
3. after 15 minutes if the patient does not improve
4. after another period of time, please specify
5. you should never give a second dose

Question 4
After the adrenaline the patient improves. She now has a GCS of 15, her blood pressure is normal, and her saturations are 99% on air. Her tongue remains swollen. What further drug / drugs (without doses) would you consider giving?

Question 5
The patient who was stung by a bee is about to go home with an EpiPen. He asks you to show him how to use it. Where should you advise him to give his injection?

1. shoulder
2. buttock (upper, outer quadrant)
3. thigh
4. abdomen

Question 6
Are you aware that there are hospital guidelines for the treatment of anaphylaxis?

Question 7
Do you know where these can be found?
Too much of a good thing, is it bad? Adrenaline on trial

Jai-deep Sood, Marianne Empson, Penny Fitzharris, Jim Stewart

Adrenaline is vital in the treatment of severe allergic reactions (anaphylaxis), however it is often underutilised or inappropriately administered. Adrenaline treatment is not without risk and most adverse reactions to adrenaline occur when it is given in overdose or as an intravenous bolus.\textsuperscript{1-3} We report a case of myocardial injury and hypotension following inappropriate administration of adrenaline.

Case report

A 40-year-old male presented to a private accident and emergency clinic with angioedema of the tongue 30 minutes after taking Paramax (paracetamol and metoclopramide).

Three years earlier, he had developed angioedema after intramuscular (IM) prochlorperazine. The angioedema had resolved with oral antihistamines. He was previously well with no cardiovascular risk factors, and was not taking any regular medications. There was no history of previous reactions with paracetamol, and there was no history of hereditary angioedema.

On presentation, he was noted to have swelling of the tongue but no difficulty swallowing or breathing, though he described a sensation of ‘air hunger and panic’. There was no rash or wheeze, his blood pressure was 140/90 mmHg and pulse 120 bpm. While waiting for an ambulance, he was given a total of 3 mg adrenaline (3 ml 1:1000); the first dose of 1 mg by subcutaneous injection, and two subsequent doses by intravenous bolus injection 5 and 20 minutes after the first dose (i.e. all within 20 minutes). He also received intravenous promethazine (25 mg) and hydrocortisone (200 mg).

At the time of retrieval by the ambulance crew (approximately 30 minutes after the first dose), his blood pressure was 180/90 mmHg and there was sinus tachycardia of 140 bpm. He was not in respiratory distress and the angioedema was resolving.

On arrival at hospital (50 minutes after the first dose of adrenaline), his heart rate was 80 bpm and his blood pressure was 74/50 mmHg. No angioedema, rash, respiratory distress, or chest pain were noted. Initial management included metaraminol 10 mg and intravenous fluids (4 litres of crystalloid and 1 litre of colloid were given rapidly).

There was some improvement in his blood pressure to 100/50 mmHg, but he developed clinical and radiological evidence of pulmonary oedema, requiring high-flow oxygen by mask to maintain satisfactory oxygen saturation. There was a prompt diuresis with a small dose of intravenous frusemide.

The ECG showed sinus tachycardia with QT prolongation (QTc 402 msec), non-specific T-wave flattening, and an incomplete right bundle branch block pattern QRS. His serum troponin T level was elevated at 0.17 mcg/L (normal <0.03) on admission, and later peaked to 2.19 mcg/L. Urgent echocardiography showed minor hypokinesis.
of the septum, anterolateral, and inferolateral walls—although the echo views were limited by pectus excavatum

He was transferred to the coronary care unit and treated according to the nonST elevation myocardial infarction protocol with aspirin, heparin, and a statin. Coronary and left ventricular angiography the following day showed normal LV contractility, (ejection fraction 59%), with minor disease of the mid-LAD, and a single severe stenosis at the ostium of a small diagonal branch of the LAD. The serum tryptase was normal (sample obtained 2 hours after admission) as were fasting lipids, C4 levels, thyroid auto-antibodies, and anti-nuclear antibodies.

After 3 days, he was discharged home with simvastatin and low-dose aspirin along with advice not to take paracetamol, prochlorperazine, or metoclopromide. A subsequent paracetamol drug challenge was negative.

Discussion

This case report highlights the dangers of inappropriate intravenous use of high-dose adrenaline in the treatment of an allergic reaction/anaphylaxis. The recommended immediate intervention for anaphylaxis is 0.3 to 0.5 mg IM adrenaline using 1:1000 dilution (1 mg/ml), (0.01 mg/kg in children, maximum 0.3 mg) every 5 minutes as necessary to control symptoms and increase blood pressure. IM injection into the thigh is reported to provide more rapid absorption and higher plasma concentration than IM or subcutaneous (SC) injection in the arm. Subsequent care includes recumbent positioning with elevation of the legs, oxygen administration, and rapid fluid replacement.

Slow intravenous (IV) adrenaline at a dose of 0.1 mg (1 ml of 1:10,000 wv 1 mg/10 ml) over 5 minutes (repeated if necessary) is reserved only for patients who remain profoundly hypotensive despite several doses of IM adrenaline and fluid resuscitation, or if they have ongoing severe respiratory distress.

IV adrenaline should only ever be used with cardiac monitoring. Adrenaline infusions may also be used in special situations such as anaphylaxis in the setting of anaesthesia. In addition, repeated IV bolus dose of adrenaline 1 mg (1 ml 1:1000 or 10 ml 1:10,000) is indicated in case of cardiac arrest.

Although there is no absolute contraindication to the use of adrenaline in anaphylaxis, adrenaline has a narrow toxic-therapeutic ratio with adverse effects of anxiety, restlessness, headache, palpitation, pallor, and tremor occurring even at therapeutic doses. Rarely, and especially after overdose, it may lead to arrhythmias, angina, myocardial infarction, pulmonary oedema, sudden sharp rise in blood pressure, and intracranial haemorrhage.

The risk of adverse effects to adrenaline is increased in patients with pre-existing cardiovascular, central nervous system, or thyroid disease; in persons using monoamine oxidase inhibitors, which block epinephrine (adrenaline) metabolism; or in those using tricyclic antidepressants or cocaine, in whom epinephrine duration of action is prolonged.

There have been many published cases where intravenous adrenaline has led to pulmonary oedema, myocardial ischaemia, and coronary artery spasm—even in young adults.
Adrenaline is an important component in the management of anaphylaxis. However, in view of the narrow therapeutic window, an appropriate dose and route of administration is mandatory. Furthermore, all medical clinics should have an up-to-date protocol stating the correct dosage and route of administration of adrenaline in the management of anaphylaxis and airway angioedema.

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**References:**

Seek and ye shall find: Hodgkin’s lymphoma presenting as paraneoplastic cerebellar degeneration

Jeanne Tie, Garry Forgeson, Andrew McNabb, Justin Roebert

Paraneoplastic neurological syndromes (PNS) are rare complications of cancer and may be the presenting sign of an occult malignancy. Diagnosis of PNS is often challenging and treatment of the underlying tumour remains the best therapeutic option for preventing further neurological damage.

We report on a patient who developed a rapidly progressive cerebellar ataxia and underwent extensive investigations before a paraneoplastic aetiology was confirmed by detection of an underlying malignancy.

Case report

In early July 2005, a 30-year-old previously fit and well Caucasian man was admitted under the neurology service with a 2-month history of worsening vertigo, imbalance, nausea, slurred speech, and blurry vision. Neurological examination on initial presentation revealed mild dysarthria; nystagmus; moderate ataxia of both upper and lower limbs associated with a broad-based gait; normal motor, sensory, and cognitive functions.

Initial imaging studies—including two CT head scans (performed 3 weeks apart) and a MRI scan of the brain/cervical/thoracic spine/MRV/MRA carotids—were normal. Two lumbar punctures performed a month apart showed persistent benign lymphocytosis and proteinæmia.

CSF infectious screen and 14-3-3 protein (for Creutzfeld-Jacob disease) were negative. Other negative investigations included an electroencephalogram, infectious screen, drug/heavy metal screen, serum ceruloplasmin, autoimmune antibodies, anti-gliadin/endomysial antibodies, and mitochondrial gene testing.

Due to the isolated cerebellar deficit, a paraneoplastic aetiology was suspected early in the course of his illness leading to an extensive search for an underlying primary malignancy. Clinical examination did not reveal peripheral lymphadenopathy. CT body scan (in late July), bone marrow biopsy, and upper and lower gastrointestinal endoscopies were unrevealing.

Serum paraneoplastic antineuronal antibody screen with immunohistochemistry were negative for anti-Hu and anti-Yo, but revealed a weak anti-TR antibody activity. A cerebellar biopsy performed in Wellington on 14 September 2005 showed extensive loss of Purkinje cells consistent with cerebellar degeneration.

In line with the presumptive paraneoplastic nature of his illness, he was treated sequentially with high-dose intravenous methylprednisolone, immunoglobulin, and plasma exchange. Despite these, his condition rapidly progressed over a few weeks with severe ataxia and downbeat nystagmus while on the rehabilitation ward. He became wheelchair-bound and dependent in all activities of daily living.
A subsequent brain and body PET/CT scans performed in Melbourne, Australia (4 months after presentation to assess the extent of cerebellar damage and to detect an occult tumour) showed increase uptake in the left inguinal and iliac lymph nodes and associated lymphadenopathy on contemporaneous CT (Figure 1). There was significant decreased activity associated with the cerebellum (Figure 2). In retrospect, a sub-centimetre left inguinal node was present on the original CT body scan.

Figure 1. F18-FDG PET CT images of the left inguinal node

Enlarged left inguinal and iliac lymph nodes (not shown) demonstrating increased uptake of F18-FDG. No uptake was demonstrated in the lower limbs to implicate a lower limb primary and there was no uptake in other nodal stations.

A left inguinal lymph node biopsy performed 5 months after his initial presentation confirmed the diagnosis of mixed cellularity classical Hodgkin’s lymphoma. He was treated with three cycles of ABVD chemotherapy followed by involved field radiotherapy, and progressed through treatment reasonably well with some fatigue and rash. A repeat CT scan after three cycles of chemotherapy showed a near complete response of his iliac and inguinal lymphadenopathy.
Paraneoplastic cerebellar degeneration (PCD) represents one of the most common and characteristic paraneoplastic neurological syndrome (PNS). In one study, 37% of 137 consecutive patients with antibody-associated PNS presented with PCD.\(^1\) It can be associated with any cancer, but most commonly with small cell lung cancer, ovarian cancer and lymphomas (particularly Hodgkin’s lymphoma).

Patients typically present acutely with nausea, vomiting, dysarthria, dizziness, slight incoordination, and diplopia. Neurological symptoms then evolve rapidly over weeks to a few months, reaching a peak within months before stabilisation, by which time most patients are severely incapacitated.\(^2\)

This case illustrates the challenges faced by clinicians in establishing the paraneoplastic aetiology of a neurological syndrome and finding the underlying tumour. Clinical syndromes are never pathognomonic for a paraneoplastic aetiology, and a high index of clinical suspicion is important. In 60–70% of patients, neurological symptoms precede diagnosis of the cancer by a few months to 2–3 years.\(^2\)
Detection of a “well-characterised” paraneoplastic antibody is extremely helpful not only for confirming the paraneoplastic aetiology, but also for directing the search for an underlying malignancy. PCD can be associated with various antineuronal antibodies. Anti-Tr antibody is directed against an unidentified cytoplasmic Purkinje cell antigen and detection of high titre (≥400) of this antibody is highly specific (95%) for Hodgkin’s lymphoma in patients with antibody-associated PCD.\textsuperscript{1,3}

Anti-mGluR1 antibodies have been found in two patients with PCD and Hodgkin’s disease.\textsuperscript{1} Anti-Yo antibodies are associated with breast and gynaecological cancers, while approximately 50% of patients with PCD and underlying small-cell lung cancer have high titres of anti-Hu antibodies.\textsuperscript{4}

In patients known to have cancer, MRI and CSF cytology are important to exclude leptomeningeal metastases. Once a paraneoplastic aetiology is suspected or confirmed, rapid identification of the tumour is paramount. The work-up generally includes a detailed history; physical examination; and CT of the chest, abdomen, and pelvis.

If the CT scan is negative, then whole-body fluorodeoxyglucose positron emission tomography (FDG-PET) or PET/CT is recommended to detect occult tumour or its metastases. In a series of 13 consecutive patients with antibody-positive paraneoplastic syndrome in whom the authors were searching for a tumour or tumour recurrence, CT and FDG-PET have a sensitivity of 30% and 90% respectively, but the combination of both methods showed a sensitivity of 100%.\textsuperscript{5} When all tests are negative, repeat evaluation at 3- to 6-month intervals for 2–3 years is recommended.\textsuperscript{2}

The outcome of PCD is generally poor. The best chance to at least stabilise the syndrome is to treat the underlying cancer.\textsuperscript{5} In an analysis\textsuperscript{1} of 50 patients with antibody-associated PCD, 7 patients (14%) improved neurologically from the time of diagnosis or start of treatment, while 32% remained stable and 54% deteriorated. All neurologically improved patients received anti-tumour treatment and complete response was achieved in all.

Survival varies between PCD patients with different antibodies. The median survival in anti-Hu patients was 7 months and in anti-Yo patients 13 months. Median survival in patients with Hodgkin’s disease associated with the anti-Tr antibody was significantly better (>117 months).\textsuperscript{1} Incidental improvement has been reported either spontaneously or in association with plasma exchange, steroids, intravenous immunoglobulin, or rituximab.\textsuperscript{7}

Our patient will have an excellent outcome from his Hodgkin’s Lymphoma with a long-term disease-free survival rate of more than 90%. Although his anti-Tr antibody was only weakly positive, Hodgkin’s disease remained the most likely aetiology of his paraneoplastic syndrome. His neurological condition has stabilised with the treatment of his Hodgkin’s disease, but there was no discernable improvement in his neurological function at his last follow-up visit, 16 months from presentation.
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References:


Disappearing drain—disaster averted and lesson learnt!

Vishwanath Hanchanale, Amrith Raj Rao, Marc Laniado, Omer Karim

Abstract

The use of postoperative drains date back to Hippocrates. We report an iatrogenic case of migrated drain into the retroperitoneum. A novel technique using a rigid cystoscope for retrieval is described that prevented another laparotomy.

Surgical drains have been used since antiquity. Drains are employed routinely after major operations to prevent haematoma and seroma formation. We report an interesting case of a migrated drain that was retrieved with a novel technique using a rigid cystoscope, thus avoiding another operation.

Case report

A 62-year-old man underwent an open subcostal left radical nephrectomy for renal cell carcinoma. At the end of the operation, the renal bed was drained using a 24-Fr Robinson tube drain which was brought out through a separate stab incision and secured to the skin with a silk stitch. On the third postoperative day, continued serous leak around the tube drain soiled the wound dressing. The drain was therefore shortened, and the end placed inside a colostomy bag by the nursing staff on the instruction of the doctor.

The precaution of securing the drain by replacing the silk stitch or using a safety pin was not followed. On the morning ward round, when the colostomy bag was checked, the drain had disappeared. The initial presumption was that the patient or one of the medical staff had removed the drain, but abdominal X-rays of the abdomen showed the drain lying on the posterior abdominal wall extending from the diaphragm to the brim of the pelvis (Figure 1).

Figure 1. Plain X-ray of the abdomen showing the vertical lie of the drain
The patient was consented for a cystoscopic removal of drain, and if this failed, re-exploration through the previous incision. Retroperitoneoscopy using a 22-Fr rigid cystoscope with normal saline as irrigant was carried out through the old drain site. The drain was seen posterior to the colon and retrieved using a foreign body grasping forceps. A new drain was inserted and fixed to the skin using a silk suture. Additionally, as a teaching point, a safety pin was also used to secure the drain (Figure 2). The drain was removed 3 days later and there were no further complications. The patient made a full recovery.

**Figure 2. Silk suture to the skin and safety pin to secure the drain**

![Image of silk suture and safety pin](image)

**Discussion**

The use of postoperative surgical drains by surgeons is a common procedure and dates back to the time of Hippocrates.\(^1\) Controlled trials have not proven the efficacy of drains in the reduction of postoperative haematoma or seromas, yet they are frequently used by the surgeons. However, drain placement is not without complications—they may cause irritation (to the surrounding structures), fracture, fragment, or migrate. Most published case reports have been on retained drain pieces due to fracture rather than drain migration.\(^2,3\)

Percutaneous retroperitoneal endoscopic retrieval of a severed piece of drain has been previously described.\(^4\) Fluoroscopic percutaneous-guided retrieval of intraperitoneal-retained foreign bodies (such as pelvic drains and swabs) has also been attempted successfully without the need for another laparotomy.\(^5\) However, review of the current literature did not reveal any report of the novel use of a rigid cystoscope to retrieve a foreign body from the retroperitoneum.

Although cystoscopic removal of the drain was possible in our case, utmost care should be taken during the early postoperative period as tissues are friable and there is a risk of bowel perforation.
Conclusion

Whenever drains are shortened, they should either be re-secured with a stitch or with a safety pin. Drain migration needs urgent management, not only to avoid potential complications but also to prevent litigation. The judicious use of a minimally invasive procedure to retrieve a foreign body may be attempted to avoid the risk of another open surgical procedure and anaesthesia. It is also cheaper and arguably less harmful to the patient.

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References:
Chronic Care Management evolves towards Integrated Care in Counties Manukau, New Zealand

Harry Rea, Tim Kenealy, John Wellingham, Allan Moffitt, Gary Sinclair, Sue McAuley, Meg Goodman, Kim Arcus

Abstract
Despite anecdotes of many chronic care management and integrated care projects around New Zealand, there is no formal process to collect and share relevant learning within (but especially between) District Health Boards (DHBs). We wish to share our experiences and hope to stimulate a productive exchange of ongoing learning.

We define chronic care management and integrated care, then summarise current theory and evidence. We describe national policy development (relevant to integrated care, since 2000) including the New Zealand Health Strategy, the NZ Primary Care Strategy, the development of Primary Health Organisations (PHOs), capitation payments, Care Plus, and Services to Improve Access funding. We then describe chronic care management in Counties Manukau, which evolved both prior to and during the international refinement of theory and evidence and the national policy development and implementation. We reflect on local progress to date and opportunities for (and barriers to) future improvements, aided by comparative reflections on the United Kingdom (UK).

Our most important messages are addressed as follows:

To policymakers and funders—a fragile culture change towards teamwork in the health system is taking place in New Zealand; this change needs to be specifically and actively supported.

To PHOs—general practices need help to align their internal (within-practice) financial signals with the new world of capitation and integrated care.

To primary and secondary care doctors, nurses, and other carers—systematic chronic care management and integrated care can improve patient quality of life; and if healthcare structures and systems are properly managed to support integration, then healthcare provider professional and personal satisfaction will improve.

Increases in the number of elderly people and of those with long-term conditions are rapidly reshaping healthcare demands. Chronic conditions in New Zealand are the leading cause of hospitalisations, use 70% of health funds, and account for 80% of all deaths. In the UK, 6 in every 10 adults have a chronic condition.

Chronic Care Management (CCM) is what Counties Manukau District Health Board (CMDHB) calls its system for managing people with chronic illnesses by enhancing primary care using reminders, decision support, and case management. Currently, this includes people with diabetes, congestive heart failure, chronic obstructive pulmonary disease (COPD), cardiovascular disease, and a pilot programme for depression. To be eligible, patients must meet specific ‘high-risk’ criteria within each condition.
Integrated Care is a wider term that describes a goal of ‘seamless’ care for patients with acute and chronic health problems at any point in the healthcare system. At its broadest, Integrated Care extends to encompass preventive care, social care, and care and support in the home, recognising that social conditions impact on health and vice-versa. It imposes the patient’s perspective as the organising principle of service delivery. It is presumed that chronic care management can be most effective when established within a wider system of integrated care.

The changing demand for care, due to the increases in the number of elderly and those with long-term conditions, is recognised worldwide. Integrated care models expect to address the growing complexity of patients needs by responding in a coordinated fashion and by providing the appropriate combination of social and home care in the community (www.socialeurope.com) We are concerned that New Zealand is falling behind in the development of such care.

Neither Chronic Care Management nor Integrated Care seek new treatments or technologies, rather, they seek to implement systems of structured care that deliver current treatments and technologies to those who need them, when and where they need them.3 We base our comments on our experience in South Auckland over the last 20 years; our interpretation of the literature; and our discussion with stakeholders and observations of ‘best practice’ in New Zealand, the UK, and the United States.

Theories and evidence supporting chronic care management

The accumulating evidence around strategies to manage chronic illness were first formulated as a single model by Wagner, who described the Chronic Care Model in 1998.4 The key strategies originally included were; mobilising community resources, creating an organisation that promotes high quality care, enabling patient self-management, promoting care consistent with evidence and patient preferences, and efficiently and effectively using patient and population data. Since then, others have variously added cultural competence, patient safety, care coordination, case management, and health promotion.

Most chronic care policies in developed countries now draw wholly or partly on this model.5 Single and multiple components from this model have been tested for their effectiveness in improving chronic care, with mixed findings as summarised in a recent systematic review2 (Box 1).

Considerable uncertainty remains about which interventions are effective when applied to a range of diseases and across different healthcare systems, and which components are beneficial within complex interventions. Two of the (many) difficulties with such research are that interventions are usually complex and are typically compared to ‘usual care’, where usual care may vary markedly across place, time, and health system.
Box 1. Strategies to improve one or more of patient experiences, quality of care, clinical outcomes, or resource use (from Singh 2005)

<table>
<thead>
<tr>
<th>Strategies to improve outcomes</th>
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<tr>
<td>Broad chronic care management models</td>
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<tr>
<td>Integrated community and hospital care</td>
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<td>Greater reliance on primary care</td>
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<tr>
<td>Identifying people at greatest risk of complications and hospitalisation</td>
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<td>Involving people with long-term conditions in decision-making</td>
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<td>Providing accessible and structured information for people with long-term conditions and their families</td>
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<td>Self-management information</td>
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<td>Self-monitoring and referral systems</td>
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<tr>
<td>Electronic monitoring and telemonitoring</td>
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<tr>
<td>Using nurse-led strategies, where appropriate</td>
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<tr>
<th>There is less evidence to support the following initiatives</th>
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<tbody>
<tr>
<td>Case management</td>
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<td>Evidence-based care pathways</td>
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<td>Shared learning among health professionals</td>
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<table>
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<tr>
<th>There is limited information about</th>
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<tr>
<td>New models of commissioning services</td>
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<tr>
<td>Appropriate data collection and monitoring</td>
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<tr>
<td>Linking health services with voluntary and community sectors</td>
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The triangle shown in Figure 1 represents the whole population broken into groups ranging from the many without chronic disease but with risk factors—at the base—to the small number at the top who have highly complex conditions and who intensively use the health services.

Integrated Care spans the whole triangle and multiple acute and chronic diseases. This triangle model, which comes in many variations relates closely to the Leading for Outcomes model used by the New Zealand Ministry of Health. Other models are summarised by Singh and Ham.

The theory of Integrated Care has also progressed over the last decade, although there is no standard definition. This is partly because Integrated Care appropriately has different implications for those with different roles in the health (and social care) systems (Box 2).

Various trials using Integrated Care models in attempts to improve health outcomes are currently underway, but as yet there is minimal reported evidence.
Policy and opportunity development in New Zealand

The New Zealand Health Strategy, published in 2000, defined high-level principles for the health system, including the need to reduce health disparities; it specifically recognised the need to reduce the impact of cardiovascular disease, diabetes, and mental illness, amongst other conditions.\(^8\)

Policymakers have recognised an important role for chronic care management and integrated care in addressing these disparities—traditionally considered outside the
domain of ‘personal health services’. The new notion is clearly expressed by Starfield:

“Personal health services have a relatively greater impact on severity (including death) than on incidence. As inequities in severity of health problems (including disability, death and co-morbidity) are even greater than inequities in incidence of health problems, appropriate health services have a major role to play in reducing inequities in health.”

The Primary Health Care Strategy, published in 2001, further defined a focus on chronic disease care, to be delivered from strengthened primary care. PHOs would replace Independent Practitioner Associations (IPAs) as the organising focus within primary care. PHOs would have more community input and population-health responsibilities than IPAs.

Over the next 10 years, funding to pay GPs would shift from fee-for-service to capitation, with greatly increased patient subsidies and therefore greatly decreased patient fees. This funding change was the most dramatic rearrangement of primary care payments and incentives in the last 60 years. Since then, 81 PHOs have been established around the country (with 3.9 million people registered), and some form of capitation payment is paid to 90% of GPs.

In Counties Manukau, most GPs are paid by a mixture of capitation plus a fee-for-service for patients older than 5 years, although in many instances care is free to patients up to age 18.

Care Plus is a national programme, introduced in 2004, which funds primary care to provide 2 hours of practice nurse (PN) and/or GP time (over 6 months) to people who are considered likely to benefit from more intensive clinical input. The system was aimed principally at strengthening support for managing people with chronic illness. It potentially includes most of those on CCM programmes, but each process is managed independently, and the population target for Care Plus includes people ‘lower’ than CCM patients on the triangle in Figure 1.

The Frequent Adult Medical Admissions scheme (FAMA), introduced in 2003, is specific to Counties Manukau and targets people who have been admitted to hospital more than twice in 12 months for a total of 5 or more days. The programme offers case management by PNs and GPs together with care coordinator nurses who are based in secondary care.

The most recent change is the PHO Performance Management Programme which is currently being rolled out. This programme introduces, for the first time, payment for performance against a small number of agreed performance indicators and targets. Only two of the current indicators are clinical and none addresses chronic diseases. These may start to be addressed with the next round of indicators, due in 2007.

In contrast, the UK Quality Outcomes Framework has a great many more clinical indicators. For example, the 2004 list includes 8 for COPD, 18 for diabetes, and 3 for left ventricular dysfunction. Furthermore, in the UK, performance incentives are paid to the practice and may account for a quarter or more of a GP’s income, whereas the payments in New Zealand are a minor proportion of payment to primary care, and are paid to the PHO.
Chronic Care Management in Counties Manukau

CCM was initiated in 2001 as part of an urgent response to an impending crisis of escalating admissions to Middlemore Hospital.\textsuperscript{12,13} CCM, together with related programmes instituted at around the same time, was credited with reducing the annual growth rate in admissions from 9% to zero,\textsuperscript{14} with a net reduction in costs.\textsuperscript{12}

Despite what appears to be an administrative and financial drive for the programme, it was always acknowledged that CCM would be successful only if health professionals could see that it improved patient care. Indeed, the roots of both CCM and Integrated Care in Counties Manukau go back a further decade to attempts to radically remodel care in some services, diabetes, respiratory diseases, congestive heart failure, paediatrics, and mental health.\textsuperscript{15-19}

A core feature of the current CCM programme is funding, training, and support for an increase of dedicated time spent with patients to proactively manage their conditions. Most of this time is spent by PNs, who are funded for up to 6 hours per year, and is supported by a computer template used by both PNs and general practitioners (GPs). This template provides a series of tick-boxes and drop-boxes that constitute a reminder and checklist for essential care and recording. The data are sent to a server and guideline-based decision support is automatically generated and returned asynchronously, so that the delay may be minutes or hours depending on computer linking schedules.

Sending data generates payments to the GPs. The diabetes and CVD programmes essentially involve documenting care, risk assessment, and tailoring patient management to optimise risk-reduction by attempting to attain evidence-based clinical targets. These are achieved using a combination of patient-held ‘wellness plans’, lifestyle intervention and medication. The programme can be completed by either the GP or the PN, though it commonly involves coordinating both the GP and the PN with the patient.

As the enrolled patients with COPD and CHF are generally ‘sicker’ than those with diabetes and CVD, and the programmes were specifically aimed at reducing hospital admissions, the care for COPD and CHF involves more intensive ‘case management’ than the other programmes.

Patient numbers enrolled in each CCM programme vary considerably. Currently there are approximately 6500 with diabetes (of an estimated 10,000 eligible); 300 with COPD (of an estimated 3000); 240 with CHF (of an estimated 3000); and 500 with high-risk CVD (of an estimated 3000).

Clearly, the diabetes process has been more successful in engaging GPs and PNs than the processes for the other chronic conditions. We have already noted that the diabetes service was an early target for integration.\textsuperscript{16} Furthermore, the CCM diabetes process built upon the free patient annual review \textit{Get Checked} that was introduced nationally in late 2000 and was subject to intensive GP and PN education and encouragement from the IPAs of the time.

The diabetes CCM process appears to benefit patients. For example, the HbA1c of the first cohort of 1544 patients dropped by 0.34% after 1 year.\textsuperscript{20}
The CHF patient numbers remain low despite the programme being acceptable to the GPs and PNs who participated in the pilot.\textsuperscript{21} Even the pilot evaluation, however, noted problems with staff time and payment. The COPD patient numbers remain low despite apparently good engagement of GPs and PNs in the randomised controlled trial that preceded the programme.\textsuperscript{19} The trial report noted, however, that both GPs and patients were volunteers, and that the participation of the PNs working with these GPs and patients was variable. In addition, the programme probably struggled to maintain momentum after the departure of the enthusiastic nurse who coordinated the project. The intervention was something of a “black box” and included not only evidence-based care plans but attention to social and home support.

Likely barriers to the uptake of these programmes include the need for patients to have an echocardiogram prior to entering the CHF programme, and spirometry prior to entering the COPD programme. Access to echocardiogram and spirometry has been partially improved by adding a trial of open-access echocardiography, separate spirometry clinics run by a Primary Health Care nurse specialist and by a drug company representative, and by using funding from Services to Improve Access (SIA). This funding stream was introduced nationally in 2004 and can be used to improve access to services for ‘high needs’ patients, defined as Māori, Pacific, and those in the lowest socioeconomic quintile.

**Lessons from New Zealand**

Overall, we can see that need for chronic disease management is well established for some conditions in New Zealand, particularly in diabetes and mental health. However, details and effectiveness of implementation, even for these conditions, appears to vary markedly around the country. We have only a limited ability to recognise and transfer best practice. We are handicapped by a lack of agreed standards for transfer of information that is vital to planning and monitoring chronic disease management, including laboratory and medication data. Such data transfer is further handicapped by lack of a national framework for patient consent as to which pieces of data can be stored and transferred, for what use and to whom.

We suggest that, in a state-funded chronic disease management system, consent should be handled by an ‘opt-off’ process rather than an ‘opt-on’ process. Despite funding and structural changes in hospitals and general practice in New Zealand, it is rare to see practice and attitudes changed sufficiently to provide the sort of care outlined in Box 1. Moreover, moves to structured, multidisciplinary care are not served by ad hoc attendances for acute events, fee-for-service funding, and increasing demands for new technology and sub-specialisation.

On the other hand, comparative strengths in New Zealand, include (in our opinion): a recent improvement in morale in primary care, perhaps related to increased funds and capitation; and some striking examples of entrepreneurial delivery of systematic care for chronic conditions such as those shown in Box 3.
Box 3. Exemplar chronic care programmes in New Zealand

<table>
<thead>
<tr>
<th>Programme</th>
<th>Region</th>
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<tr>
<td>The Bold Promise Project (Auckland)</td>
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<td>The Foundation Project (Wairarapa)</td>
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<tr>
<td>The Ngati and Health Programme (Gisborne)</td>
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(No attempt is made here to be complete. A current Health Research Council / District Health Boards of New Zealand project will produce a national stocktake of programmes.)

Lessons from the United Kingdom

Compared with New Zealand and most other countries, the UK has more fully-developed plans for managing chronic conditions. In their case this has been possible due to all patients being registered with a GP, a centralised system for managing and funding primary healthcare provision that is free to the patient.

Centralised information systems enable primary healthcare trusts (with a geographic base and a defined population) to define the healthcare needs of their community. Quality Outcomes Framework uses multiple clinical and process indicators to link practice and GP pay to performance. The same centralised information systems help stratify patients according to healthcare risks and need for interventions, and updated the information daily to support practice planning and activities including recall.

The UK makes greater use (compared to New Zealand) of ‘healthcare centres’—some are nurse-led, thus giving members of a multidisciplinary team a ‘home’ and facilitating a team focus in their geographic community. Finally, the UK has committed a large amount of money to the project. New Zealand appears to have under-estimated the funds and human resources needed to support the change of practice required to establish and run multidisciplinary chronic-care clinics in general practice.

Nevertheless, discussions with stakeholders in the UK also indicate some negative factors which may undermine development of integrated care. These include: demoralised GPs (partly due to repeated change and a system of top down control); lack of local ‘buy-in’ for the same reasons; GPs and nurses working in ‘silos’; and poor relationships between hospitals and primary care.

How Counties Manukau might respond to new evidence and opportunities

Counties Manukau is likely to enact all of the strategies listed in Box 1, for which there is evidence. The DHB and PHOs have an ongoing programme of health needs assessment for their populations, with a specific mandate to address health inequalities. We consciously use the triangle shown in Figure 1 to stratify people so that they can receive healthcare services according to their needs and to their likely use of secondary care services.

We will continue to support care at home or in the community where possible, rather than in hospital. We expect to increasingly use nurses, pharmacists, and other health
professionals to deliver or supplement systems and processes of care. In some instances, this will replace doctors’ roles, but will largely be additional, complementary to, and supportive of doctors’ roles.

We will specifically support establishing multidisciplinary teams in primary care supported by specialist advice. This advice will be both in person as specialists work beside primary care providers as well as embodied with information systems including templates, reminders, and decision support. We have begun adapting established ways to support patient self-care for local use. Suitable models include the Flinders model, the Lorig model, and the Expert Patient Programme from the UK.

As an embodiment of all these trends and intentions, the DHB, together with the PHOs and the University of Auckland, hope to develop a trial around community hubs or health centres which will provide nurse led care with visiting GPs, hospital specialists, and providers of social / home support. This will work best if supported by national systems and policies and include training schemes, appropriate remuneration, and some standardisation of clinical information systems, none of which is yet guaranteed.

It is clear both from experience and from the literature that apparently-small differences in programmes may have a major impact on uptake and effectiveness, even when comparing projects that are all based on best-practice guidelines and designed specifically to enhance patient care. Health systems are recognised as classic examples of ‘complex systems’ in which the effects of interventions are unpredictable, and in which ongoing evaluations are vital, both for current programmes and for any further changes in the way health care is delivered.

Co-operation and co-ordination across traditional professional and organisational boundaries must be specifically fostered and managed. And, above all else, enthusiastic clinical leadership committed to patient centred care is required for any integrated care project to succeed.

With this leadership, integrated care may progressively become a reality despite imperfectly aligned incentives, and organisational and professional boundaries. Without it, we will remain trapped in our current system that, to paraphrase Berwick, is perfectly designed to produce the same—inadequate and inequitable results—that we currently ‘enjoy’.

Competing interests: Meg Goodman, Gary Sinclair, Allan Moffitt, Kim Arcus, and Sue McAuley are (or were) employees of Counties Manukau District Health Board (CMDHB). Harry Rea has a clinical commitment to CMDHB; is a member of the DHBNZ-Research Fund Governance Group; and Chairs its Chronic Care Steering Committee. Tim Kenealy has a general practice in the CMDHB area. John Wellingham is Chair of the Quality Board of the RNZCGP; is a Clinical Director of Enigma Publishing; is Chair of the DHBNZ Research Fund for Diabetes research; and is a member of the DHBNZ Chronic Care Steering Committee.

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Manukau DHB, Otahuhu, Auckland; Sue McAuley, Clinical Research Manager, Centre for Clinical Research & Effective Practice (CCRep), Counties Manukau DHB, Otahuhu, Auckland; Meg Goodman, Primary Health Care Nurse Specialist, Counties Manukau DHB, Otahuhu, Auckland; Kim Arcus, Programme Manager, Primary Health Care Strategy Implementation, DHBs and Ministry of Health, Wellington

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3. Woolf SH, Johnson RE. The break-even point: when medical advances are less important than improving the fidelity with which they are delivered. Annals of Family Medicine. 2005;3:545–52.


I have now demonstrated that for the ignorant or perverse minority who prefer the attentions of the unqualified, there is ample choice in New Zealand of quacks of all varieties, and for the sensible majority there is a supply of about 600 qualified men and women practising in this colony. Of these just 100 have been educated at the Otago Medical School, and hold the diploma of the New Zealand University, with in most instances, English, Scotch or Irish qualifications superadded. The Otago Medical School has been sending up candidates for medical diplomas for twenty years, Dr Christie, formerly of Tokomairiro, and now of Bristol, England, who qualified as M.B., B.Ch. in 1887, being the first medical graduate of the New Zealand University.

Since then 107 have obtained medical diplomas and a great majority of these are now in successful practice in the towns and country districts of New Zealand. In addition to those who have completed their curriculum at the Dunedin school, there is a considerably greater number who have been partly educated here and who, after completing their course in Great Britain, have returned to New Zealand to practice.

The influence of the Otago School is therefore a very pronounced factor in the personnel, training and attainments of the New Zealand practitioners. I make bold to say that it has been a good and wholesome influence, and that the Otago School deserves well of the public. It offers facilities for the medical education of the poorer members of the community, who would otherwise have been debarred from this privilege and in many other ways has more than justified its existence.

The School has suffered and still suffers from certain defects and deficiencies due to inadequate financial resources. In order to make both ends meet, the strictest economy has to be practised and only the bare essentials purchased. It was but 2 years ago that the Otago University found itself in a position to relieve Professor Scott of the double duties of teaching anatomy and physiology, and to engage Professor Malcolm to conduct the classes in the latter subject, and this notable advance was only rendered possible by the magnificent gift of £2,000 from Mr. Wolf Harris, a former citizen of Dunedin, noted for his liberality and public spirit.

Other subscriptions amounting to a considerable sum were recently raised amongst the people of Dunedin and the surrounding districts to further aid the finances of the Otago University. People indeed of all grades gave liberally according to their means, but what we lack in this colony are the large donations and legacies for the cause of education, such as are given by the superabundantly wealthy in other countries.

Proceedings of Health Research Society of Canterbury’s AGM and Scientific Meeting, Wednesday 21 March 2007

Pilot studies into biological factors that may contribute to ethnic disparities in cancer survival in NZ

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Cancer mortality in Māori is now double that of non-Māori in NZ. This disparity has been attributed to socioeconomic and cultural factors. However, differences in mortality persist after adjustment for tumour stage, raising the question of biological differences. Recent US studies have demonstrated that biological factors (growth factors, hypoxia factors) and co-morbidities (diabetes, hypertension) may contribute to ethnic disparities in cancer survival. Our aim was to analyse biological factors which may contribute to cancer mortality. We hypothesised that ethnic disparities in cancer survival may be due to a) tumour hypoxia, which contributes to poor outcome via increased tumour aggressiveness and resistance to therapy, and b) co-morbidities, since the incidence of diabetes in NZ Māori is elevated. Hypoxia factors (hypoxia inducible factor-1 (HIF-1), glucose transporter-1, carbonic anhydrase-IX (CA-IX)) in tumours and circulating factors (insulin-like growth factor-1 (IGF-1, regulates HIF-1)) in serum were compared between self-declared Māori and NZ European patients. Our data in 40 patients (14 matched pairs of self-declared Māori and NZ European patients with breast cancer, 6 matched pairs with colon cancer), show associations between hypoxia factors and clinical prognostic indicators. However, no significant correlation was found between ethnicity and hypoxia factors by immunohistochemistry. Western blot analysis of colon tumour samples indicated increased levels of CA-IX in Māori patients. Serum IGF-1 levels in Māori patients appeared higher than in NZ European patients. These initial findings in a small patient cohort support the hypothesis of a biological difference between cancers from different ethnic origin.
Sensory aspects of airway protection in ageing and Parkinson’s disease

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The aim of this study was to evaluate sensory aspects of airway protection in healthy ageing and in Parkinson’s disease (PD) using nasendoscopy and inhalation cough challenge. Forty-eight participants, gender equally represented, were divided into 3 groups: Group 1- healthy, young adults, mean age 25.1; Group 2- healthy elders, mean age 72.8 and Group 3- patients with Idiopathic PD, mean age 71.7. All underwent sensory testing during nasendoscopy during which sensation was tested using the tip of the endoscope at bilateral base of tongue (BOT), posterior pharyngeal wall (PPW) and aryepiglottic fold (AEF). Inhalation cough challenge using citric acid was administered. There were no differences in sensitivity at BOT, PPW and AEF between young adults and elders. Patients with PD had significantly less sensation in the (R) and (L) BOT compared to healthy elders. In healthy young adults, elders and PD normal cough threshold was always significantly lower than the suppressed cough threshold (p=.001). There was no difference between young adults and elders for natural cough thresholds (p=.102), but a significant difference in suppressed cough thresholds (p=.021). Elders have a significantly lower suppressed cough threshold when compared to young adults. Natural and suppressed cough did not differ between healthy elders and those with PD. Young adults are better able to suppress cough compared to elders. This may suggesting reduced tolerance for noxious stimuli in elders and/or reduced cognitive control when asked to suppress cough. Reduced BOT sensation in patients may account for a delay in swallowing process, thereby increasing aspiration risk.

Microfluidics for bioartificial livers

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Bioartificial Liver (BAL) is a term for medical devices designed to replace natural liver functions. The idea behind the use of artificial livers is to either externally support an injured liver to recovery or bridge a patient with a failing liver to transplantation. Our aim was to investigate the effect of microfluidic channel geometry on the modulation of oxygen transport to liver cells cultured in a Bioartificial Liver (BAL) bioreactor. Analytical calculations and finite-element simulations of fluid dynamics in microchannels were used to determine the influence...
of wall-shear stress on oxygen transport in a microchannel containing a liver cells culture. To ensure hepatocyte survival over the full length of the bioreactor, an optimum channel shape for a constant oxygen concentration was calculated and a prototype bioreactor device was fabricated in Polydimethylsiloxane (PDMS) using soft lithography techniques. Fluid-dynamics simulation results regarding the effect of channel geometry on oxygen transport show good agreement with the analytical model able to predict channel geometry. Cell cultures in straight rectangular bioreactors are shown to be limited by high oxygen metabolism of hepatocytes. Through channel tapering wall-shear stress can be made to increase linearly within biological limits, while as a result oxygen concentration remains constant over the length of the bioreactor. Tapered bioreactors are fabricated in PDMS and bonded onto a glass substrate. Successful fluid flow and sealing is shown by application of a dye coloured liquid. A two layer design with 36 bioreactors demonstrates the feasibility of device scale-up towards a clinical size BAL. A geometrical approach to overcome transport constraints in micro-scale bioreactors has been introduced. Simulation results show that oxygen transport can be modified by customizing the shape of the reactor channel. Prototype bioreactors have been fabricated and tested. Selective cell seeding and the integration of a sensor to experimentally verify oxygen concentrations are currently being investigated.

Diagnosing cardiac disease states using a minimal cardiovascular model

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Cardiovascular disease states are difficult to diagnose due to a variety of underlying dysfunctions combined with reflex mechanisms. To provide more consistent care a cardiovascular system model is combined with an efficient patient-specific parameter identification method. The goal is to identify the patient’s condition and to predict the future patient-specific reaction, making this approach a potential means for model-based guided therapy. The model and parameter-identification method are validated using clinical haemodynamic data measured during drug induced porcine pulmonary embolism experiments (N=6) and PEEP titration experiments (N=6). Identified model parameters are correlated to create predictive measures of haemodynamic changes to clinical therapy or patient condition. Prediction is tested for observed changes in arterial pressure (AP), pulmonary arterial pressure (PAP) and stroke volume (SV) as caused by a clinical change in PEEP. The parameter-identification method tracked pulmonary embolism in porcine data from an initial healthy to the disease state. The full range of haemodynamic responses was captured with mean errors of 4.1% in the pressures and 3.1% in the volumes. Pulmonary resistance increased significantly with the onset of embolism, as expected, with the percentage increase ranging from 89.98% to 261.44% of the initial state. Changes in AP, PAP and SV due to an increase in PEEP were predicted with a mean absolute percentage error less than 10%
for 6 data sets. These results provide a first clinical validation of this model-based
diagnostic therapeutic decision support approach to haemodynamic management.

**Direct effects of proangiotensin-12 on the isolated rat heart**

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Proangiotensin-12 (PA-12) is a recently discovered component of the renin-
angiotensin system. We provide here the first report of direct effects of PA-12 upon
the heart. Rat hearts were perfused via the Langendorff isolated heart system
recording changes in perfusion pressure and contractility. Samples of perfusate were
collected prior to and after passing through the heart and submitted to specific
Angiotensin II (AII) RIA and RP-HPLC. Infusing the heart with 0.1-10 nM PA-12
showed dose-dependent constriction of the coronary arteries, becoming significant at
10 nM (P<0.000), and showing no significant influence on contractility. PA-12 had
approximately 10 fold less potency in constricting coronary arteries in the rat heart
when compared with AII. Co-infusion of PA-12 with CV-11974 (an angiotensin
receptor 1 inhibitor) significantly prevented constriction (P=0.014) suggesting PA-12
(or its active derivatives) bind and activate this receptor. IR-AII was not present in
pre-perfusates (PA-12 does not cross react with anti-AII antibody) whereas IR-AII
was present in post-heart perfusate. RP-HPLC confirmed that PA-12 was converted
by cardiac tissue to IR-AII, which may then be responsible for the observed response.
Our results show PA-12 is a novel piece of the renin-angiotensin puzzle with a
functional role in cardiovascular homeostasis. We suggest PA-12 is initially modified
into AII, (its active form) by the tissue in order to bind and produce the observed
haemodynamic effects.

**Dissociation of neopterin and 7,8-dihydroneopterin from plasma
proteins during analysis**

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Measurement of plasma neopterin is used clinically as a marker of immune cell
activation in the management of cancer, viral infections and post-operative transplant
patients. Macrophages release neopterin and 7,8 dihydronopterin during
inflammation. HPLC analysis of neopterin is usually performed following acid
precipitation of serum/plasma proteins. However, under acidic conditions, 7,8-
dihydronopterin is oxidised to neopterin with varying yield. We examined the use of
the solvent acetonitrile (ACN) to remove plasma proteins. Plasma samples were
treated with either trichloroacetic acid or ACN to precipitate serum proteins. Deproteinated plasma was either oxidised to convert the 7,8-dihydroneopterin to neopterin or directly analysed for neopterin by reverse phase HPLC with fluorescent detection. Use of 50% ACN prevented the loss of 7,8-dihydroneopterin while achieving a higher level of protein removal. HPLC chromatograms showed baseline resolution, giving a significant increase in the signal to noise ratio. Surprisingly the use of ACN appeared to release more pterins than usually observed with acid precipitation. Analysis of ten septicaemia patient’s plasma and five healthy controls showed that the ACN method consistently gave ~20nM more neopterin then the acid precipitation method. Total pterin concentrations were on average 50% and 200% greater in healthy and septicaemia subjects respectively when measured by ACN. The average neopterin concentration from healthy controls was 22nM, twice the literature threshold of < 10nM. Our data suggests that some pterin co-precipitates with proteins during acid treatment. The use of ACN to remove serum proteins is a significant improvement in time and accuracy over existing acid based procedures to measure serum pterin.

Effect of myeloperoxidase-derived oxidants on endothelial cells

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Inflammatory cells are a major source of biological oxidants. One of the most reactive oxidants generated by neutrophils is hypochlorous acid (HOCl). The reaction of HOCl with biological components produces a variety of different oxidants such as chloramines. Although many of these oxidants retain the oxidising ability of HOCl they are generally less reactive. We investigated the ability of three chloramines; NH$_2$Cl, Gly-NHCl and Tau-NHCl to induce apoptosis on human umbilical vein endothelial cells (HUVECs). NH$_2$Cl was consumed rapidly by the cells and induced apoptosis at 5 µM. Gly-NHCl was less permeable, and a higher concentration of, 50 µM Gly-NHCl was necessary for inducing apoptosis. Tau-NHCl did not penetrate the cell and no apoptosis was observed even at high concentrations. Myeloperoxidase will also generate HOSCN from thiocyanate and this can also react with cell thiols. We found that HOSCN could enter the cells to some extent, but that apoptosis was not seen at any of the concentrations tested. At high concentrations, however, necrotic cell death was observed. This study highlights interesting differences in the outcome of cell exposure to myeloperoxidase-derived oxidants, with varied levels of thiol oxidation, apoptosis and cell death in HUVECs.
Mouse models towards human neural tube defect genes

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Human neural tube closure defects occur at a high frequency (1 in 1000 pregnancies) resulting in spina bifida, anencephaly or craniorachischisis. These birth defects have a strong genetic component illustrated by monozygous twin studies and increased recurrence risks. However, inheritance is complex and aberrant expression of an undefined developmental gene or genes is believed to underlie the sporadic occurrence in humans. We have used the severe neural tube defect (NTD) Loop-tail mouse as a model for human NTD. This inbred strain stably inherits the defect as a Mendelian trait with healthy and fertile heterozygotes displaying a distinctive looped tail defect. Positional cloning using an intra-specific backcross between the Loop-tail and CBA strains of mice. We identified the Lp defect in Vangl2, a gene first identified in Drosophila and known to affect cell polarity. A point mutation results in an amino acid substitution (S464N) thought to affect interaction with downstream proteins. Expression analysis confirmed temporal and spacial transcripts at closure 1 in wild-type littermates, which is the site of neural tube closure initiation. Since this finding, other severe NTD mice have arisen which were tested for mutation in Vangl2. However, five different genes underlie their phenotype; all members of the planar cell polarity (PCP) pathway, which has emerged as crucial for convergent extension and axial elongation movements in the developing embryo. We have recently identified several heterozygous variants in human PCP genes. We propose compounding combinational variation in PCP genes as the cause of a proportion of human neural tube closure defects.
Iatrogenic air


A 69-year-old female with a history of arterial hypertension (and left mastectomy 13 years previously) was admitted for surgery on her right ankle fracture under general anaesthesia.

Six hours after surgery, the patient became hypertensive and cervical subcutaneous emphysema was noted. A chest radiograph (Figure 1) followed by a thoracic CT scan (Figure 2) were taken.

What is the diagnosis?
Diagnosis and Discussion

The diagnosis was pneumomediastinum and pneumopericardium, shown on Figure 1 with an arrow and a dotted arrow respectively. Figure 2 confirms these findings.

The aetiology\(^1\)\(^-\)\(^2\) of this pneumopericardium is mechanical ventilation. Elevation of intra-alveolar pressure during mechanical ventilation causes alveolar breakage with exiting air, that progresses to dissect the bronchial and perivascular spaces and finally cross the parietal pericardium.

In our case, the coexistence of pneumopericardium, pneumomediastinum,\(^3\)\(^-\)\(^5\) and subcutaneous emphysema suggests the most likely aetiology is an iatrogenic injury post-intubation and, consequently, a direct tracheobronchial-pericardial communication in a patient with an antecedent of a breast tumour and thoracic radiation.

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References:

**Obesity and hip joint replacement**

There is strong evidence to suggest that obesity is a factor in the development of osteoarthritis of the hip, particularly in those with a high body mass index (BMI) in early adulthood. And it has been rumoured that outcomes of hip replacement are worse in the obese. But is the rumour true? Probably not.

An editorial analysis of the relevant literature does not suggest that obesity predicts a worse outcome. Indeed one paper shows outcomes to be the same in obese and non-obese subjects after a mean follow-up period of 14.6 years.

But what about the very obese? It appears that problems of mobilisation and of the functional outcome do become apparent when the BMI is in the region of 40 kg/m$^2$ or greater, bearing in mind that obesity is defined as a BMI $>30$ kg/m$^2$. And finally, even in these patients, the improvement in their quality of life is still considerable and, provided they have been made aware of the increased risks, operation should not be withheld.


**And again, the doctor’s dilemma—an American viewpoint**

We have recently alluded to George Bernard Shaw’s view that the dilemma doctors faced was choosing between helping patients and helping themselves to lucrative fees.

In this short paper, Douglas Kamerow, a disillusioned GP and former US assistant surgeon general, says that today’s doctor’s dilemma is that what we do doesn’t make much difference.

He points out the in the US only half of adults over 50 get screened for colorectal cancer. A third of smokers don’t receive advice to quit. Less than 60% of elderly people have ever had pneumococcal vaccine. Twenty per cent of children under three have not received all recommended immunisations.

Furthermore, we (he means the US, but I believe it applies to all of the “Western World”) spend billions of dollars inventing and testing new drugs that only marginally extend the benefits of those they replace, rather than putting resources into better delivery of existing effective services.

He concludes by offering the opinion that “most authorities are now convinced that education—years in school—has the most direct causal effect on how long people live. For every extra year spent in school, life expectancy is extended 18 months.”

*BMJ 2007;334:126*
Suspected acute stroke—is magnetic resonance imaging (MRI) of the brain better than computed tomography (CT) in the emergency setting?

It has been suspected that MRI would be best as brain CT is insensitive in picking up acute ischaemia in the first 48 hours. This paper reports on a prospective trial comparing non-contrast CT with diffusion-weighted MRI in a cohort of 356 patients, 217 of whom later had a confirmed diagnosis of stroke. The results overwhelmingly favoured MRI.

MRI detected acute stroke (ischaemic or haemorrhagic), acute ischaemic stroke, and chronic haemorrhage more frequently than did CT (p<0.0001, for all comparisons). MRI was similar to CT for the detection of acute intracranial haemorrhage. MRI detected acute ischaemic stroke in 164 of 356 patients (46%), compared with CT in 35 of 356 patients (10%).

So we should order MRI in all cases—why don’t we? This issue is discussed in an accompanying editorial which highlights the point that about 11% of patients were unable to undergo MRI imaging, mainly because of claustrophobia, the presence of cardiac pacemakers, or neurological or medical instability.

In New Zealand, there is also the point that we do not have enough MRI machines or radiologists (and are unlikely to have such in the immediate future).

Lancet 2007;369:293–8 and 252–4

More about drug-eluting stent thrombosis—and how to prevent it

This is currently a very hot topic in cardiology (see Methuselah NZMJ 23 March 2007). There are several aspects to consider—clinical and financial. Clinical first.

The widespread adoption of dual anti-platelet therapy (aspirin and clopidogrel) has been shown to reduce stent thrombosis in both drug-eluting stents (DES) and bare-metal stents (BMS).

Generally, treatment with clopidogrel is given for 6 months post-stent (in New Zealand PHARMAC authorises such a period). The authors of this paper propose, after their observational study, that the extended use of clopidogrel in patients with DES may be associated with a reduced risk for death or MI. However, the appropriate duration for clopidogrel administration can only be determined within the context of a large-scale randomized clinical trial.

And financial—at around $3000 each, the drug-releasing stents cost more than three times the bare-metal ones.

And clopidogrel 75 mg daily for 6 months cost just over $1000 (and double that for 12 months. Methuselah recalls that William Heberden (1710–1801), yes he of the nodes, noted that new medicines and new methods of cure always work miracles…for a while.

JAMA 2007;297:159–68
Prevention of cardiovascular and cerebrovascular disease—is the polypill the answer?

Some years ago, Wald and Law proposed that the combination pill (consisting of aspirin, an ACE inhibitor, a beta-blocker, a statin, a diuretic, and folic acid) would be useful as a population-wide intervention to prevent cardiovascular and cerebrovascular disease (BMJ 2003;326:1419 (28 June); A strategy to reduce cardiovascular disease by more than 80%; http://www.bmj.com/cgi/content/full/326/7404/1419). Critics have noted that the diuretic and folic acid may be the least valuable drugs in the polypill. So what has happened? Nothing yet.

But the World Heart Federation recently announced that it would support the development and evaluation of a polypill consists of aspirin, an ACE inhibitor, and a statin. In this short paper, Dr Reddy notes that two Indian drug manufacturers have already developed four-drug combination pills (the fourth drug being a beta-blocker) and will soon begin clinical trials.

So in several years (how many—10, 20, 30?) we will have evidence for the benefits of the polypill.

**Chlamydia trachomatis: discovery of a new strain**

A variant strain of *Chlamydia trachomatis* was recently detected in Sweden. The laboratory was alerted to possible false negatives due to a decrease in the positivity rate; a trend which was inconsistent with the past several years.\(^1\)

The laboratory used two test methods (one commercial and one in-house) and when testing 1100 samples found 11 discrepant samples. The discrepant samples have been sequenced and a deletion of 377 base pairs was found in the target area for the *C. trachomatis* NAAT tests manufactured by Abbott and Roche.\(^1\)

So far, this strain has been found in Sweden and two samples were found in Norway (one of the patients being Swedish). Despite efforts to locate the strain in other parts of the world, it has not been found.

In January 2007, Roche Diagnostics New Zealand initiated a local quality assurance scheme to determine if the variant strain is present in our population. Upon consultation with an epidemiologist and statistician, it was decided that a sample size of 500 patients would be sufficient to give reasonable certainty that the variant is not present in New Zealand.

The major regions of Auckland, Waikato, Bay of Plenty, Wellington, and Christchurch were chosen and DNA extracts were collected. The samples had tested negative using either the Roche Amplicor or TaqMan assay, which cannot detect the variant due to the deletion. An alternative assay on the LightCycler instrument was used to assess the prevalence of the variant *C. trachomatis* strain by targeting a different region of the *Chlamydia* genome unaffected by the deletion.

A total of 500 samples were tested for the presence of the variant strain, and the distribution is shown below (Table 1). Samples were a mixture of swabs and urines, and represented samples from both GPs and Sexual Health Clinics.

<table>
<thead>
<tr>
<th>Region</th>
<th>Number Tested</th>
<th>LightCycler Result</th>
<th>Amplicor/TaqMan Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auckland</td>
<td>116</td>
<td>Neg</td>
<td>Neg</td>
</tr>
<tr>
<td>Waikato</td>
<td>81</td>
<td>Neg</td>
<td>Neg</td>
</tr>
<tr>
<td>Bay of Plenty</td>
<td>96</td>
<td>Neg</td>
<td>Neg</td>
</tr>
<tr>
<td>Wellington</td>
<td>132</td>
<td>Neg</td>
<td>Neg</td>
</tr>
<tr>
<td>Christchurch</td>
<td>75</td>
<td>Neg</td>
<td>Neg</td>
</tr>
</tbody>
</table>

Current recommendations in England and Wales by the Health Protection Agency do not advocate switching assays. They state that laboratories who are using Roche or Abbott platforms as their only method of *C. trachomatis* detection “should carry on using this approach but be vigilant for obvious decreases in the number of positives cases”.

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**Table 1. New Zealand sample distribution and results**
Alternative PCR test methods which use a different target should only be used if reasonable indications exist. Confirmatory testing with a chromosomal target like the one that was used in this study is available in New Zealand.

We have not been able to detect the variant strain in our study, however we are aware that the possibility of the variant being present in New Zealand cannot be completely excluded based on these results. This lack of variant is further confirmed by the fact that the CT prevalence rates in New Zealand continue to rise, in contrast to the Swedish situation.

Jennifer Barnes, Fabrice Merien
Applications Specialists
Roche Diagnostics NZ Ltd
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Reference:
Prevention of colchicine toxicity in patients with gout

We read with interest the case series of patients with serious toxicity related to colchicine overdose reported by Dr Jayaprakash and colleagues. In particular, the three cases of accidental fatal overdose in patients prescribed colchicine highlight serious concerns about inadequate management of gout in New Zealand as the root cause of the problem.

Gout is a major cause of musculoskeletal morbidity in our community; recent analysis from a large primary care practice has shown that gout affects, in South Auckland, 14.9% of Pacific men, 9.3% of Māori men, and 4.1% of men of European origin (Personal Communication, Richard Hulme, East Tamaki Healthcare, 2006).

Gout accounts for more than 200 admissions to Middlemore Hospital annually and is now the most common cause for new patient referral to rheumatology clinics at Counties Manukau District Health Board (CMDHB casemix data 2006). Despite the high prevalence of disease in our community, this disease is frequently under-treated and mismanaged.

We are particularly concerned about the under-prescription of urate-lowering therapy, and the over-reliance on anti-inflammatory agents for management of chronic gout—in the form of non-steroidal anti-inflammatory drugs (NSAIDs), corticosteroids, or colchicine. While these agents are moderately effective in treating and preventing acute gout flares, they do not prevent tophus formation or joint damage, frequently seen in our patients with chronic gout.

Urate-lowering therapy, particularly allopurinol, is indicated for patients with gout, and any one of the following: early onset disease, recurrent acute flares (≥2/year), radiographic damage, tophi, concomitant renal/cardiovascular disease, or diuretic therapy. For many patients currently on allopurinol, doses are inadequate and do not lead to sufficient lowering of the serum uric acid to <0.36 mmol/L—the target required for suppression of acute gout flares and regression of tophi.

To prevent recurrent flares, joint damage, and irreversible disability, we strongly encourage early use of urate-lowering therapy for patients with gout, with regular monitoring of serum uric acid levels. Such therapy should also allow for less reliance on more toxic therapies such as NSAIDs, colchicines, and corticosteroids, thus reducing the likelihood of the adverse outcomes as described by Dr Jayaprakash.

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References:


Burns treatment—with a response from Middlemore Hospital’s Burns Unit

Burns victims who have lost a large portion of skin are in danger of fluid loss. Expensive skin substitutes and special beds are among the repertoire of the current mode of treatment.

Could the burns victim not be suspended in a bath of solution of mixed salts that resemble extracellular fluid? These solutions have been made in physiology departments at universities for over 50 years. In these solutions, kept warm and aerated, rat or rabbit hearts and pieces of gut are able to be maintained over a number of hours or even days. A solution of this sort used for a burns victim would stop fluid loss, drying out and painful shrinkage of tissue, prevent heat loss, and enable the administration of antibiotics without the pain of application.

The body floating in the serum-like fluid would not have the pain of burned tissue resting on a surface (however high tech), and burned tissue that can be toxic could be safely removed at a stage long before it might have been possible when fluid loss was a risk.

I am presently enquiring whether baths suitable for this treatment might be made in China and have asked for a bath in clear plastic so that the body can be easily viewed in the bath. I have the recipe for the solution that is suitable for mammals.

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Response

The use of saline baths is well described and in fact was used in World War II and popularised by Sir Archibald McIndoe while he treated burned airmen. Dr McIndoe was adamant that saline would be ‘better’ than the use of tannic acid which toughened the skin and created horrible scars and delayed wound healing.

Dr McIndoe was a New Zealander that trained in Dunedin and became world known for his contribution to the burned airmen of World War II, the ‘Guinea-pigs Club’. He went to great lengths by writing many letters to ensure that the forward troops eventually were not soaked in tannic acid but were bathed in saline when possible.

The saline baths were indeed comfortable and modern burn units often use baths today especially for children where the soothing effect is quite notable especially of superficial, very painful, burn wounds. The pathophysiology of burn injury, however, is such that the internal inflammatory response is only minimally altered by external baths/showers.
Modern burn care requires quick removal of burned tissue and early grafting which was not practiced when saline baths were introduced and made popular. The actual loss of fluids in the early days following burn injury has more to do with leaky capillaries than leaking through the skin, hence the reason why bathing in saline does not really have an effect on the haemostasis.

Saline baths and other forms of hydro therapy are also under closer scrutiny in many burn units as they are one of the key sources of cross-contamination documented in the literature. In its day, saline baths were a huge step forward, and New Zealanders can be proud that this aspect of burn care was popularised by one of their own.

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The prevalence of misleading tobacco descriptors in the New Zealand tobacco market

**Background**—The New Zealand Commerce Commission has recently commenced an investigation into the misleading use of the terms “light” and “mild” on cigarette packets in New Zealand. Such action is fully consistent with New Zealand’s treaty responsibilities, since part of the Framework Convention for Tobacco Control requires action on misleading descriptors. To inform the political and official considerations on this issue, we undertook an examination of the prevalence of light and mild descriptors for tobacco products in the New Zealand setting.

**Methods**—We examined data provided by tobacco manufacturers to the Ministry of Health for tobacco products in 2005. The findings were contextualised with New Zealand survey data on smokers’ beliefs and international publications identified on Medline searches.

**Table 1. “Light” and “mild” descriptors used in cigarette labelling in NZ in 2005**

<table>
<thead>
<tr>
<th>Descriptor</th>
<th>Number of brands using that descriptor*</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Mild”</td>
<td>11</td>
</tr>
<tr>
<td>“Ultra mild”</td>
<td>1</td>
</tr>
<tr>
<td>“Superior mild”</td>
<td>1</td>
</tr>
<tr>
<td>“Extra mild”</td>
<td>4</td>
</tr>
<tr>
<td>“Menthol mild”</td>
<td>4</td>
</tr>
<tr>
<td>“Super mild”</td>
<td>6</td>
</tr>
<tr>
<td>“Golden mild”</td>
<td>1</td>
</tr>
<tr>
<td><strong>Subtotal—any “mild”</strong></td>
<td><strong>28</strong></td>
</tr>
<tr>
<td>“Lights”</td>
<td>12</td>
</tr>
<tr>
<td>“Deluxe lights”</td>
<td>1</td>
</tr>
<tr>
<td>“Super lights”</td>
<td>2</td>
</tr>
<tr>
<td>“Ultra lights”</td>
<td>2</td>
</tr>
<tr>
<td>“Menthol lights”</td>
<td>1</td>
</tr>
<tr>
<td>“Classic lights”</td>
<td>1</td>
</tr>
<tr>
<td>“Silver lights”</td>
<td>1</td>
</tr>
<tr>
<td><strong>Subtotal—any “lights”</strong></td>
<td><strong>20</strong></td>
</tr>
</tbody>
</table>

*There were two brands that had both “lights” and “mild” as descriptors (i.e. “Mild Seven Superlights” and “Mild Seven Lights”) and so these are counted twice in this table.

**Results**—The terms “light” and “mild” are common descriptors in the New Zealand tobacco market in 2005 (Table 1). Collectively, 44% of the manufactured cigarette brands listed for sale in 2005 contained at least one of the brand name descriptors listed in the Table (46/104). In terms of manufactured cigarettes sold in New Zealand in 2005, those with at least one of these descriptors comprised 28% of the market (i.e. 665 million out of 2345 million cigarette sticks). Assuming an average of 20 cigarettes per packet, this equates to 33 million packets annually with these descriptors printed on them.
We identified one survey with data on the descriptor issue in New Zealand – a survey of 2709 smokers.\textsuperscript{4} It reported that 36% of the sample smoked light or mild cigarettes (27% of Maori, 40% of females). Those who reported smoking light and mild were asked why they smoked these types (they could give more than one reason). In the unprompted responses, 23% provided some health-related reason for their choice, and a further 5% thought that light or mild cigarettes were “less addictive” and/or “easier to quit”.

**Discussion**—This analysis found that “light” and “mild” descriptors are commonly used to describe New Zealand cigarettes. Yet this analysis may underestimate the scale of this marketing strategy as it did not include descriptors such as “low tar”, descriptors on packets of roll-your-own tobacco and packet colouring (e.g. light blue colouring) which may be used to imply “mildness”.\textsuperscript{5}

The international literature suggests that many smokers choose “mild” or “light” cigarettes because they think that these cigarettes may be less harmful to their health than regular cigarettes.\textsuperscript{6-9} In a survey of smokers in Canada, USA, Britain, and Australia, large proportions believed that “light” cigarettes had some reduced health risk compared to regular cigarettes (Canada: 43%, US: 51%, Australia: 55%, UK: 70%).\textsuperscript{10}

The New Zealand survey data also indicate health-related beliefs for choice of light/mild cigarettes (as detailed in the *Results* section above). The lower proportions reporting smoking light/mild cigarettes because of reduced health risk compared to the international surveys cited above probably reflects the unprompted nature of the question.

However, the epidemiological evidence suggests that the health outcomes from smoking light/mild cigarettes are as grave and as common as those from smoking other cigarettes.\textsuperscript{11} Furthermore, smoking lights does not appear to lead to greater quit attempts, despite a greater wish to quit amongst such smokers.\textsuperscript{12}

There is evidence that many smokers are switching to lights/mild on the mistaken assumption of reduced health risks, instead of quitting,\textsuperscript{15} and tobacco companies appear to have been deliberately using the descriptors to encourage this behaviour.\textsuperscript{14} As a result, light and mild descriptors are helping to maintain the high smoking prevalence and severely undermining efforts to reduce the health effects of tobacco within the New Zealand population.

This evidence suggests the current Commerce Commission investigation into the light and mild issue in New Zealand is wholly appropriate. The danger of misleading cigarette brand names also suggests that the Commission needs to consider misleading brand names such as *Freedom*, as argued elsewhere.\textsuperscript{15} Currently this further action is not being considered by the Commission.\textsuperscript{16}

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Competing interests: Three of the authors (NW, GT, RE) have previous undertaken work for the Ministry of Health or non-governmental agencies working to improve tobacco control.

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5. King B, Borland R. What was "light" and "mild" is now "smooth" and "fine": new labelling of Australian cigarettes. Tob Control. 2005;14:214–5.


Graham Frank Joplin
1927 – 2007

Graham was Wellington born and bred, and attended Island Bay School and Wellington College, where his father was a master. He graduated from Otago Medical School in 1951—a high flyer in a high flying year. House jobs in Wellington led to academic posts (including Professor of Endocrinology) at the Postgraduate Medical School (Hammersmith Hospital, London) where he had a distinguished career.

Graham was a meticulous clinician who believed in the value of careful observation and how this would lead to a better understanding of how disease behaved.

As a result, he published a long series of papers in international journals which literally established modern endocrine treatment.

People flocked from around the globe to visit the Unit that he and Russell Fraser established at Hammersmith Hospital. His patients always did exceptionally well, simply because he listened to (and examined) them so carefully.

The team he led was of the highest standard because he put such weight on effective education and maintaining the strongest esprit de corps. He was a very kind man, worked tirelessly and frequently entertained his team at home—his charming wife, Helen, had been his ward sister, and their two daughters are truly carbon copies of their parents.

His chirpy good humour was perhaps his most engaging asset. He was delighted once to be able to relate a collision of his Austin 7 with a cow in rural New Zealand, which resulted in a bellow from the latter, and total destruction of the former. Camping with Graham was great fun; problems were dealt with by ingenious improvisation, and transport arranged by anything from hitch-hiking upwards. The best example of the former was a lift from some IRA lads in Ireland, and of the higher levels of transportation, landing in a propeller plane in a sandstorm in Egypt. He barely escaped with his life, but later gave his usual incisive and intelligent lecture.

Shortly before retiring he sadly developed severe Parkinsonism which eventually left him incapacitated and needing institutional care, and from which he died.

Final memories are of a quiet self-effacing man who made an enormous contribution to endocrinology, but who always put people first—family, colleagues, patients. He was a role model and it is very difficult to be as good, hospitable, funny, and as fond of orchids as Graham.
Professor Stephen Bloom (Graham’s successor at Hammersmith) and Dr Peter Dykes (Birmingham) compiled most of this obituary. Additional information on Graham’s early life in New Zealand was provided by Dr Colin Fenton (Wellington), while Dr Bill Brabazon (Auckland), another of Graham’s contemporaries, coordinated its writing and sending to the NZMJ.
David John Scott

David Scott—an inspirational, avuncular, beloved physician—is going to be sorely missed by all who knew him whether as a friend, mentor, colleague, crewmate, or patient. We will remember his stooped bespectacled form speaking slowly, gently, and so patiently to the suffering; explaining medical concepts clearly to his students; or sharing experiences and insights with friends and colleagues. For David, time never mattered, *people* did.

David was born on 4 June 1930 in Christchurch. The insecurities of those Depression years took the family to Hutt Valley and then to Otorohanga where his mother taught at school until his father obtained work in Auckland. Living conditions were very cramped until they settled into a state house in Meadowbank where David became Dux of the local school.

He moved on to Auckland Grammar School and did well academically, was a librarian, a member of the Chronicle editorial committee, and contributed an illustrated article to it.

In sport, he represented the school in athletics in the half-mile relay team and was a courageous fullback for the Rugby Second XV. Although without financial backing other than his bursary and holiday earnings, he entered the Otago University Medical course. He lived frugally with fellow ex-Grammar students Ashley Symmans and Dick Kulka in a Dunedin flat. Later he enjoyed communal life in Carrington Hall. He was a popular familiar figure astride his red ex-army Indian motorcycle and participated enthusiastically in student activities such as Capping celebrations.

After First Professional, David was chosen to focus on research and tutoring which led to his BMedSci degree. He graduated MBChB in 1956. House Surgeon and Registrar years were spent at Auckland Hospital. Exemplary case notes in his distinctive legible handwriting reflected the meticulous patient care he delivered then and later.

In precious spare hours with friend, David Gray, he built a 2.1m (7’) Sabot pram sailing dinghy in a consultant surgeon’s garage to take them for quick spins on the harbour between duties.

Later he worked his passage to England as a ship’s doctor to pursue postgraduate studies at London’s Hammersmith Hospital. After the postgraduate course he worked at The General Hospital in Birmingham. Then he returned to Hammersmith to work with the noted New Zealander, Professor Russell Fraser, first as his house physician, then as a research fellow studying new techniques and treatment for diabetes. During this period he gained his MRCP.
He made a return trip to New Zealand to propose to and marry Tig Rix-Trott from Auckland—a partnership which has faced and weathered several tragedies with a strong faith and stoicism that was truly inspiring.

A BNZ Research Fellowship in the Department of Endocrinology and Nuclear Medicine brought David back to Auckland. On his return journey he stopped in New York and studied the revolutionary new technique of radioimmunoassay of hormones with Drs Yallow and Berson. With their help he was able to introduce this technique to New Zealand. With considerable ingenuity, David’s new laboratory was able to measure growth hormone levels, and later other hormones. The treatment of pituitary tumours with implanted radioactive Yttrium seeds, and management of growth abnormalities, were other contributions he made. Also, he improved the management of diabetic retinopathy utilising retinal photography and fluorescein angiography.

In Auckland, the family soon settled with John (his brother) and his wife (Tig’s sister) in a joint home on a lifestyle block in Clevedon, Manukau City. Their six children (Rebecca, Tim, Roger, Emma, Serena, and David), along with John’s family formed an industrious community practising the self-sufficient ‘good life’. Some years later David’s family moved closer to the sea to Kawakawa Bay.

When the Auckland Medical School was founded in 1969, David was appointed as one of the Senior Lecturers in Medicine. Thus were combined his gifts of research, teaching, and clinical work with patients. Some 12 years later, his research convinced him of the serious diabetic problems developing in South Auckland and the necessity of attacking this through a focused team approach based at Middlemore Hospital.

In 1980, he took sabbatical leave and studied developments in diabetes management in Nottingham. On his return he relocated to Middlemore Hospital where he remained until his retirement. By developing close relations between General Practitioner, Nursing staff, and Community workers, he encouraged patients to understand and address their own condition and daily needs. For years his work began at home at a very early hour as patients phoned him to report their morning blood sugar levels and learn the insulin requirements for the day.

Despite such devotion to his calling, David made time for creative expression. He was a purist and lover of nature. He designed and made functional furniture in a minimalist way that brought out the beauty of the colour, grain, and feel of wood. His small keeler was moored near his home and cruising in it gave him great joy. In 1997 he joined David Gray in part of a New Zealand circumnavigation—Dusky Sound to Oban via the South Cape of Stewart Island.

In addition to his research papers, he edited several books including a history of Auckland Hospital and later a history of Middlemore Hospital. After retiring he returned to University for courses on literature and writing. He wrote poetry and even edited a book of poems, including one of his own. He had the ability to capture the essence of his thought and subject matter without embellishment. Also, at this time, David’s holistic concern for patients and their families drove him, with much patience and persistence, to negotiate for and establish a multifaith Spiritual Centre at Middlemore Hospital—‘A Place of Peace for All People’. He faced his own terminal illness with courage and fortitude and died on 4 March 2007.
David was able to be so devoted to his profession because of the unselfish support from Tig, whose faith and strength of character were remarkable throughout. They tragically lost two grown children from traffic accidents, and recently another son from leukaemia. Surviving children are Rebecca, Serena, and David together with nine grandchildren.

For this contribution we are grateful to Dr David Gray, a long time friend from school and university days. Much appreciated assistance was given to him by the Rev Samuel McCay, a patient and friend; Dr David W Scott, David’s son; and David Scott’s hospital colleagues.